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General Editor
Prof. Sagarmal Jain

SCIENTIFIC CONTENTS IN PRĀKṚTA CANONS

Dr. N. L. Jain

PAṆṆĀ SAMIKKHAE DHAMMAṀ

PĀRŚVANĀTHA VIDYĀPĪTHA, VARANASI.

About the Book

There has always been two categories of scholars — traditionalists and moderates. It is the later who carry the torch of knowledge ahead. The scientific age has resulted in increase of moderate scholars with scientific outlook presuming knowledge as ever-flowing river. The Austrian indologist and Dixit have initiated the approach of studying Jainology with historical and scientifically evaluative perspective to contain the current of faith erosion.

The early Jaina Canons contain about one-third of their contents related with physical world. The above approach directs to treat these contents as specific to those periods and as mile-stone in development of thought process. This book is an attempt to induce this approach to cover the contents in the areas of Chemistry, Physics, Botany, Zoology, Food Sciences and Medical Sciences. The material presented here will convince the reader that ıeligious themes have also been undergoing changes like scientific concepts and therefore science should not be degraded on this score. Secondly, the book will lead one to learn that the Jainas have had better intellect in contemporary theorisa-tion. However, their physical observations on visible phenomena seem to be quite insufficient in number and variety in views of our current knowledge, which has not only supplemented them to a large extent but has given better understanding and clarity on many issues. This non-traditional book has a point to improve the status of scientificity in religion to strengthen faith in moral and spiritual values.

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SCIENTIFIC CONTENTS IN PRĀKṚTA CANONS

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PĀRŚVANĀTHA VIDYĀPĪTHA
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Publisher's Note

This institute has been bringing out books on various familiar and non-familiar aspects of Jainology developed out of scholastic efforts of the authors since early fifties of this century. Almost all its publications belong to the category of intellectual nutrition designed for the thinking people very few in number even in this age of scientific development. Despite this, its publications have earned credit for thier quality of contents throughout the scholarly world in India and abroad. They have now reached all the continents of the world of today. The popularity of these publications can be judged by the facts that almost a fourth of its publications have gone out of print with similar number running in more than one editions.

The institute is proud to publish its eighty-fourth book entitled "Scientific Contents in Prākṛta Canons" by Dr. N. L. Jain who worked on it under the Humanity Research Scheme of the University Grants Commission, New Delhi and approved by them for publication. As the name indicates, the book summarises and evaluates the Scientific Contents (on six subjects Chemistry, Physics, Botany, Zoology, Food Science and Medical Science) contained in the major Jaina canonical and pro-canonical literature up to about tenth century. This book encourages us to study these contents with historical and comparative perspective giving due credit to the ancient and medieval Jaina saintly scholars for their ingenuity, keen observation and conceptual power. It shows that they have contributed to almost all the branches of knowledge involving physical sciences which have been only stray explored. Our two earlier publications authored by J. C. Sikdar have encouraged us for this adventure. The author has exhaus-

tively dealt the contents with critical and comparative approach in the fields of the subjects discussed in this book. This is a thought provoking book to encourage the scholars to work. Similary in the subjects other than those dealt with in here. It is hoped that this book will make a valuable contribution not only in history of science in Jainology but in the over all history of world science also. The book, thus, will serve as a landmark in the world of Jainology in particular and Indology in general in the area of scientific contents.

We are extremely grateful to the U.G.C. Delhi and to Dr. N. L Jain for allowing us to publish this book.

I am thankful to Dr. Sagarmal Jain, Director, Dr. Ashok Kumar Singh and Dr. Shriprakash Pandey, Research Officers of the institute for seeing it through the press. I must also appreciate the other academic staff of the institute who have helped in various ways in publication of the book.

Shri Upadhyayaji of Naya Sansar Press and Shri Rajkumarji of Vardhaman Mudranālaya have taken great pains in bringing out this book. I must appreciate their efforts.

B. N. Jain
Secretary
Pārśvanātha Vidyāpīṭha

Introduction

Every religious system in the world has either a single sacred book or a set of such books called scriptures. They may be either revealed, divine or self-experienced in origin. The Jaina system has a self-realised twelve-fold book-basket in the main to which many secondary texts were added. These scriptures contain (i) narrations and instructions for moral or spiritual development, assumed to be eternal truths and (ii) many non-eternal, physical and verifiable facts. The followers of the faith are called upon to take them as all-time truth and unchangeable ones. However, *Vaiśeṣika-sūtra-Upaskāra* has raised the question about their authenticity on the basis of many (i) untrue (ii) contradictory and (iii) repeatatory statements in them causing doubt, prejudice and confusion. These points were satisfied by assuming the scriptures to be divine and non-violable. A similar notion might have been raised in the examination-based Jaina system even in early centuries. They, therefore, postulated some criteria for authenticity of their sacred scriptures. Collectively, they are as follows :

(a) The scriptures must be composed by the *Āptas* (Attaineds) who have special qualifications mentioned in literature.

(b) Their contents should be non-contradictory with respect to sensory perception and inference or contradictory proofs must be absent about postulates and statements.

(c) They should be consistent with prior and posterior texts.

(d) They should be devoid of logical or experimental discrepancies.

(e) Their statements should be non-violable by any process. Samantabhadra, Siddhasena, Akalaṅka and other

scholars emphasized the examination-based nature of Jaina system in comparison to the merely faith-based one. This led to critique texts in Jainology. The tradition of such texts continued upto about 12th century which gave a prestigious image for the system. Both types of contents in sacred texts were intellectually or intuitionally examined by them.

The twentieth century scientific age has gone more critically analytical of old concepts and practices to confirm them or indicate about their modifiability. It attempts to elaborate the scriptural, spiritual and physical facts and phenomena not only intellectually but by experimental evidences also. This dual support strengthens our faith. The scientific mind is not satisfied with the concepts like divinatory, revealatory or self-experiencial origin of scriptures. It has, however, been found that the Jaina system holds a superb place not only contemporarily but all-timely also in the field of moral or spiritual instructions and many physical conceptualisations. The Jainas have shown intellectual giantness in many fields through their

(1) Karmic theory (cause-effectism or Newton's third law),

(2) Non-absolutist synthetic approach in philosophical postulates, a little ahead of the theory of relativity,

(3) Concept of simultaneous existence of physical and psychical aspects in subjects and objects and

(4) Theory of micro and macro – non-violence and limiting desires in practical life.

These principles form the core of religions. The scientists have nothing to say but to appreciate all this. The current age has a credit to expand their sphere of action from purely individual to society, nation and world. However, when one looks at the extra-religious contents of the scriptures with scientific eye, one observes that there seems to be sufficient ground for examining them directly and deeply. Jainas have shown that the criteria of authenticity in scriptures fail partly or wholly due to —

(i) unverifiable but ideal concept of the Attaineds (modified later as specialists) as composers of scriptures.

(ii) containment of many inter or intra-contradictory statements in canons violating the criteria of consistency,

(iii) containment of many perceptual, inferential and logical contradictions.

Moreover, the criteria of unchangeability of postulates is also violated because many of their contents do have (i) definitional (conceptual), (ii) numerical, (iii) namal, (iv) sequential and (v) reductio-incremental modifications as shown in Table 1 in some typical cases whose references could be found in relevant chapters which start from the first book of *Ācārāṅga* onwards. The final point has been shown in the end against each entry in the Table.

Table 1 : Some Typical Conceptual and Physical Modifications in Jaina Scriptures.

(A) Conceptual / Definitional	
1. Religion	Three-fold, four-fold, five-fold
2. Definition of *Upayoga*	Knowledge & Conation : Bliss & energy etc. in addition
3. Definition of Direct Perception	Without-sense knowledge With/without-sense knowledge
4. Birth-types of 1-4 sensed beings	Asexual to sexual also
5. Shape and volume of Universe	Different in *Sūtras* and *Dhavalā;* 239-343R.
6. Animistic Concept	Animistic and non-animistic concept
(B) Sequential	
7. Order of Realities/*Tattvas*	As like Gītā : Logical (Umāsvāti)
(C) Namal	
8. Six essentials	Partial difference in Dig. & Svet.

9. Six types of Living	Pre-*Ācārāṅga* and post-*Ācārāṅga*
(D) Namal and Sequential	
10. *Pratimās* /Model Stages	11 (number same, names different by Somadeva & Hema candra Ācārya)
11. Reflections	12 (Names and order different)
12. Truths	10 (Names, order, definitions different in *Rājvārttika* & *Sthānāṅga*
(E) Numerical and Reductio-incremental	
13. Number of *Tattvas* / *Padārthas*/Realities	10, 11, 9, 7 (Umāsvāti)
14. Conduct/practices	5-fold, 4-fold, 3-fold (Gem-trio)
15. Scriptures, Perverse, worldly/black	9, 19, 26, 29
16. Basic Qualities of Mendicants	18, 27, 28, 36, 36 (Vidyānanda Muni)
17. Vows (*Vratas*)	5, 6,12 (With/without holy death)
18. Positings (*Nikṣepas*)	6,4 (Umāsvāti)
19. Disquisition Doors	14, 20, 23, 24, 36, 9, 8, 6 (Umāsvāti)
20. Puffs	8 (RKS), 4 (SK)
21. Causes of Karmic bondage	4, 5 (Umāsvāti)
22. Predications of *Syādvāda*	3, 4, 7
(F) Physical Observations	
23. Male Arts	72 (with different names, now totalling 140)

24. Female Arts	64 (with different names, now totalling 140)
25. Number of Diseases	7, 10, 16 (with different names, now totalling 64)
26. Medical Practices	5 increasing upto 36
27. Parts of the Body	9, 32 (*Ācārāṅga*)
28. Number of eatables/ dishes	9,14,18
29. Types of Food	6, 8, 4
30. Organs of Knowledge (*Pramāṇas*)	4,2 (with sub-classes)

Currently, this state of variability in scriptural contents could be clarified on at least five counts as below :

(a) Almost all the current scriptural and post-scriptural texts have been redacted and composed by sufficiently distant (upto 500 years or more after Mahāvīra) saintly authors.

(b) Absence of transmission or communication between contemporary and other scholars and their literature in olden days with some exceptions.

(c) An attitude towards supporting traditionalism under incomplete or indirect informations.

(d) A gradual but continuous loss of memory and intuitional genius among the successive generations of scholars leading to variable understanding.

(e) Contemporary challenges and an attitude towards correspondence based on relativity principle.

It, thus, seems that each series of Mahāvīra's near and distant disciples took his instructions in their own way though they were in popular language of the time and in simple allegorical style with reference to their contemporary correspondence. That is why, many later scholars felt many types of inconsistencies in scriptures. Most of them, however, preferred to keep silence to maintain them as such on the basis of nonviolability without venturing any elaboration. One could not say

whether academic honesty supports this attitude. Deep faith associated with timidity will, however, definitely favour it. This seems like a clear over-looking of instructions of the seers from *Ācārāṅga, Sūtrakṛtāṅga, Uttarādhyayana, Niyamasāra, Pramāṇa-mīmāmsā* etc. to use the innate nature of curiosity and intelligence to examine the contents before acceptance by using the science of logic. The current 200-300 years have developed an additional tool of experimental examination. However, it has been pointed out that scriptures could be taken as authentic on issues which are out of bounds of logistics and experimentation.

Moreover, this trend of critique and intellectual examination could not be maintained in medieval period because of political circumstances, lack of better quality of genius as pointed by Shastri and sin-fearing attitude leading to conservatism and loss of multi-faceted growth of Jaina studies. The current scientific age requires re-adopting the forgotten critique type of attitude to re-establish the excellence by moving a little forward from the current static state and following basic canonical instructions and newer technics. Amar Muni has also hinged on this point.

The current age has two types of scholars including many sages-traditionalists and moderates. This has always been the case. However, the later category has been in acute minority. But it is the only category which is or has been wanted most and which carries the torch of knowledge ahead. The industrial revolution and literacy drive have added fuel to the firy mind resulting in increase of moderacy. They have now realised that though the traditionalism has maintained their system, they have also been instrumental in internal faith erosion and reduction in religiosity. If it has to be checked, larger number of moderates, logicians and scientifically grounded scholars must come forward to serve as newer commentators and prestige-earners of the Jaina system.

The moderates have a scientific outlook. They maintain

that knowledge is an everflowing and growing river rather than a static pond. Hence, the knowledge contained in texts of different periods should be taken as specific to those periods and a mile-stone to future growth fronts. Thus, the contents of ancient periodical texts should be studied and analysed with historical perspective. This gives a chance for evaluating the growth of knowledge in different periods. This approach was initiated by the Austrian Indologist in case of Jainology which has been followed by Dixit in this country. The author feels that by adopting this attitude, one is in a position to clarify many earlier inconsistencies at any time without disregard to earlier scholars who had their own limitations of intelligence, studies and experiments. This will also validate the ancient texts on this basis, thus maintaining the continuance of faith in them. Of course, this perspective gets somewhat blurred in cases of those systems which have shown little sense for history. However, it is the current scholar's duty to approximate this history from the available material and contents. It is also felt that this has not probably been the case with many authors of articles, books, booklets on some subject-matters covered by this academic attempt despite the fact that some could mention the differences in canonical and current physical facts. Modern scientific age, therefore, requires to collect, classify and discuss at least the physical contents in early Jaina canons mostly written in Prākṛta language, in a co-ordinated way so that it could be comparatively evaluated with respect to its growth and current state of knowledge. An additional advantage of this exercise will be that it will be let known to the science historians of the world who are little informed about these contents and their overall contribution to the history of science.

These objects have encouraged to undertake the current work. This is a partly materialised form of the project entitled Scientific Contents in Prākṛta Literature approved by the University Grants Commission, New Delhi, under their humanities research scheme. It has covered only six subjects : (i) Chemistry,

(ii) Physics, (iii) Botany, (iv) Zoology, (v) Food science and (vi) Medical sciences. It contains 17 chapters, 880 references, 129 tables and 5 diagrams. The author wishes to extend this work to other subjects like mathematics, astronomy, astrology, geography, engineering etc. which will form the basis for another publication.

The general scholars will find this presentation in a non-traditional format covering the past and present. It has many informative and comparative tables and diagrams to instil better clarity and support for statements made leading to evaluative relationship. The references have been kept to minimum and given at the end of the chapters in current traditions as practiced in humanities avoiding quotations, thus, minimising the space. A large number of references include those of current authors working in this direction. This is in contrast with traditional publications. The terminology of Jaina terms used here follows the pattern of glossary published by Jaina International, Ahmedabad (1995) which stands approved by many noted Jaina scholars. Many discordant notes and suggestions for further studies and guidance by competent canonists have also been mentioned as and where required. The author wishes this exercise may lead them to be in a position to realise the trend in growth in knowledge and estimate the position of Jaina system in current comparision. They may realise many points not in tune wirh their traditional conceptions.

The author does not feel himself to be a competent scholar either in Jaina system or science. However, whatever background he has, he has tried to study the relevant literature for his neutral analysis. He does not claim that his studies are complete while undertaking this exercise for his inferential comments. The deeper scholars will, therefore, do well to point out flaws or additional informations to correct or modify his views. The author will be highly pleased to receive such comments and criticisms.

The author could not have undertaken this exercise

without the encouraging approval of the UGC and its Deputy-Chairman Prof. Murthy. He could also not complete this work without the co-operation of (a) institutions like Pārśvnātha Vidyāpītha, Varanasi; Jaina Viśva Bhārtī, Ladnun; Prākṛta Institute, Vaisali; Vīra Sevā Mandir, Delhi; Jaiṅa Kendra, Rewa and Girls College, Rewa (who allowed free access to their libraries), (b) individuals like Prof. M.A. Dhaky, Dr. Sagarmal Jain, Muni Mahendraji, Late Pt. J. M. L. Shastri, Dr. V. P. Dubey, Prof. M. K. Bhargava, Late Johrimal Parekh, Miss Sheela Goel and others (whom I troubled many times to remove my ignorance in part on issues of language and concepts) and (c) many publishers who supplied me necessary books when asked for. I hope they will be extending similar help in any future adventure like this. The author has a sense of deep gratitude to all of them and also to them not mentioned. I will be doing injustice if I do not give due credit to my wife, Mrs. Kshama Jain and children who have pleasantly suffered great inconveniences due to my study room and long hour working. I hope they must now be pleased to see this outcome in this form.

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In the end, I must express my sincere thanks to the Director and managing committee of Pārśvnātha Vidyāpītha, Varanasi for publishing this volume.

July, 1996 **N. L. Jain**
Rewa, (M. P.)

Abbreviations

Books

1. A — Ācārāṅga
2. ADS — Anuyogadvāra Sūtra
3. AGDT — Anāgāra Dharmāmṛta
4. AKT — Antakṛtddaśā
5. AN — Ācārāṅga Niryukti
6. ANU — Anuttaropapātika Sūtra
7. AUP — Aupapātika Sūtra
8. Ay — Āyurveda
9. B — Bhagavatī Sūtra, Buddha
10. BA — Bhagavatī Ārādhanā
11. CON — Cosmology, Old & New
12. D — Dhavalā, Digambara
13. DD — Disquisition Door
14. DSV — Daśavaikālika
15. GS — Gommaṭasāra
16. JD — Jayadhavalā
17. JDK — Jñātādharma Kathā
18. JDP — Jambūdvīpa Prajñapti
19. JPP — Jaina Path of Purification
20. JPV — Jambūdvīpa Prajñapti Vṛtti
21. JSK — Jyotiṣkaraṇḍaka
22. KK — Kalyāṇakāraka
23. KS — Kāma-sūtra
24. KV — Kalpasūtra-vṛtti
25. MR — Mūlācāra
26. N — Nandī-sūtra Vṛtti
27. NL — Numerable Lacs

28.	NS	—	Niyamasāra
29.	NT	—	Numerable Thousands
30.	NV	—	Nyāyá-Vaiśeṣika
31.	PPB	—	Praśastapāda Bhāṣya
32.	PRJN, PS, P	—	Prajñāpanā Sūtra
33.	RKSR, RKS	—	Ratna-karaṇḍa-śrāvakācāra
34.	RP	—	Rājapraśnīya
35.	RS	—	Rasa Ratna Samuccaya
36.	RV	—	Rājavārttika
37.	S	—	Śvetāmbara, Sāṅkhya
38.	SDS	—	Ṣaḍ-darśana-samuccaya
39.	SGDT	—	Sāgāra Dharmāmṛta
40.	SK	—	Sūtrakṛtāṅga
41.	SKD	—	Ṣaṭkhaṇḍāgama
42.	SS	—	Sarvārtha-Siddhi
43.	Sth.	—	Sthānāṅga-Sūtra
44.	STR	—	Śiva-tattva-ratnākara
45.	SV	—	Samavāo
46.	TP	—	Triloka-prajñapti
47.	Ts	—	Trilokasāra
48.	TS	—	Tattvārtha-Sūtra
49.	TSR	—	Tattvārtha Sāra
50.	TV	—	Taṇḍula Veyālīya
48.	UTN, U	—	Uttarādhyayana
49.	V	—	Vaiśeṣika
50.	VN	—	Vātsyāyana Sūtra
51.	VS	—	Vipāka-sūtra

Publishers

1.	APS	—	Agama Prakashana Samiti, Beawar.
2.	BJ	—	Bharatiya Jnanapitha, Delhi.

3. CJP	—	Central Jain Publishing House, Lucknow.
4. HSS	—	Hindi Sahitya Sammelana, Allahabad.
5. JSS	—	Jaina Samskriti Sanrakshaka Sangha, Solapur.
6. JVB	—	Jaina Vishva Bharati, Ladnun.
7. NS	—	Nirnaya Sagar Press, Bombay.
8. MLBD	—	Motilal Banarasidas, Delhi.
9. PVRI	—	Parshvanath Vidyashrama Research Institute, Varanasi.
10. SJS	—	Shvetambara Jaina Sthanakavasi Sangha, Sailana.
12. SS Jaina Sanstha	—	Shvetambara Sthanakavasi Jaina Sanstha, Bikaner.

System of Transliteration

Vowels

अ	आ	इ	ई	उ	ऊ	ए
a	ā	i	ī	u	ū	e
ऐ	ओ	औ	अं	अः	ऋ	
ai	o	au	aṁ	aḥ	ṛ	

Consonants

क्	ख्	ग्	घ्	ङ्
k	kh	g	gh	ṅ
च्	छ्	ज्	झ्	ञ्
c	ch	j	jh	ñ
ट्	ठ्	ड्	ढ्	ण्
ṭ	ṭh	ḍ	ḍh	ṇ
त्	थ्	द्	ध्	न्
t	th	d	dh	n
प्	फ्	ब्	भ्	म्
p	ph	b	bh	m
य्	र्	ल्	व्	श्
y	r	l	v	ś
ष्	स्	ह्	क्ष्	त्र्
ṣ	s	h	kṣ	tr
		ज्ञ्		
		jñ		

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Section One

Prākṛta Language and Canons

Various studies of Prākṛta Language indicate it as one of the oldest and most popular laymen's language of ancient Indians during early pre-Christian centuries. Mahāvīra and Buddha popularised it through their sermons and consequently it became a literary language. The major subject matter of this work is related with Prākṛta canonical literature spread over many centuries. Though primarily localised, it spread throughout the country due to royal patronage and wandering monks. It is found in many forms. *Ardhamāgadhī* is a specific name given by the Jainas in its pre-developmental stage. It is, therefore, necessary to have a preliminary idea about it and its literature.

This section contains four chapters concerning

(i) the language, i. e., Prākṛta Bhāṣā

(ii) literature survey, i. e., Prākṛta Canons

(iii) branches of learnings mentioned in this literature, i. e., Branches of Learning in Canons

(iv) techniques of studies in ancient times, i. e., Canonical Techniques of Objective Studies.

These chapters form the basis of ensuing chapters and sections. The readers will find them an interesting and informative reading.

Chapter 1

Prākṛta Bhāṣā

Man is a social being. He is mutually related with others, co-existingly associated with animal kingdom and moving and enjoying around natural surroundings with feelings and emotions. He requires a medium for communicating his intentions, emotions, thoughts and desires etc. for his ways in the world. Language is such a vehicle for expressing all such activities. These may be effected through all the perceptual senses like touch, taste, smell, sight and hearing (signals, symbols, symptoms, etc.). These mediums are employed by the sentients like men and animals and insentients like natural objects (rivers, oceans, etc.) alike. However, when we talk about language in modern sense, it has comparatively a limited meaning. It refers to the *medium for human species only. The ancient* symbolism did not prove sufficient for the above purposes and the spoken language was the natural outcome. And hence, it refers to the organ of hearing and speech only. Currently, the language, in general, consists of in the pronunciation of sounds, words etc. to be meaningful. The word 'language' is now defined as an ordered structure of arbitrary sound symbols pronounced through human speech organs and through which speaking, hearing and later writing activities are performed in specific groups[1]. It is clear that without language, a man can not become a man. That is why, the science of linguistics has been developed in the west during the last two and half centuries. It studies the (i) language characteristics like (a) arbitrariness, (b) acquiremental nature, (c) creativity, (d) imitability, (e) transformability, (f) dual levelling, (g) non-finality, (h) speakability and audibility; (ii) its internal and external structures under five major heads like (a) syntax, (b) morphology, (c) wordology, (d) phonetics

and (e) semantics; (iii) its applied aspects like origin, classification, comparative studies and other topics. It is seen that each language or its group has its own characteristics. Though there is difference between languages (mental, nonmaterial; speech, material), still, it is the speech which represents the language.

Origin of Language

The ancient major religions of the world assume the vitalistic theory about their scriptural languages (Hindus – *Saṃskṛta,* Buddha –*Pāli,* Jainas –*Ardhamāgadhī,* Christians – Hebrew, Islam –Arabic). They presume their language as the origin of all the world languages. However, Plato presumed the naturalistic origin of languages. The intelligensia nas not accepted this view. Experiments since 500 B.C. upto fifteenth century organised by Psammitichos of Greece to Akbar (1556 – 1603) have shown that the children remained dumb or without language when kept aloof for long times. Herder concluded in 1772 that there cannot be any vitalistic language logistically and scientifically. However, the origin of language is still a problem for the linguists. Despite many theories with individual defects, it is now agreed that many direct factors have co-operatively taken part in the development of a language. These may be denoted as (a) symbolism, (b) conscious and unconscious imitation, (c) sound conformability, (d) interjectional, emotional and gestural expressions, (e) sing-song and (f) intellectual and emotional contact and interaction. Sweet and Johnson[2] have developed the co-ordinated theory of the origin of language on some of these points. However, no single factor could be pointed – an issue awaiting answer from the intelligensia. Indirect methods in this direction have also not yielded substantial confirmation on this issue.

The *Saṃskṛta* scholars have postulated four stages through which language appears in spoken form[3] — *Parā, Paśyanti, Madhyamā* and *Vaikharī* — the last one forming the

audible sound or speech. The other three stages are finer inaudible sounds leading to audibility through emotions, air contact and movements, thus giving basic importance to air and respiration. The Jainas associate origin of speech through conversion of *kārmic* species attracted by mental activities into sound variforms (groupings). This stage occurs at a sufficiently developed state of human mind. The difference in the different languages of the world may be ascribed to physical, social and cultural environment, incomplete imitation, simplicity trends, the theory of survival of the fittest, mental status, etc. The language due to fine mental emotions followed the gross emotional sounds. The factors, accounted for the origin of language by Western scholars, may be said to be in the zone of mental activity. Thus, the Western thoughts seem to be elaborations of Eastern ideas.

Whatever be the origin of language, it has developed in three stages — (i) bodily actions or symbols, (ii) vocal symbols and (iii) written form. The first stage expresses only gross emotions, requires light and directness and it has a limited scope. The vocal stage has no such difficulty except place and time. The written stage has even removed these limitations.[4]

Classification of Languages

The Indian maxim that language changes every 16 miles (25 kms.) has been superseded by the actual number of 2796 languages in the world. Their alround systematic study is possible only when they are scientifically classified. This has been done on the basis of — (i) religion, (ii) continents, (iii) countries, (iv) historical periods, (v) symptoms, (vi) typography or syntax and (vii) family or geneaology. Out of these, only the last two are linguistically important.

The typographical classification is based on morphology or the structure of language. Many authors have suggested more than two varieties but proper consideration suggests that

primarily there are two varieties under this category with some sub-varieties as shown below :

- Language
  - Analytic (*Ayogātmaka*) (Isolating, Positional, non-agglomerating, Chinese)
  - Synthetic (*Yogātmaka*) (Agglomerating, prefix-suffixed)
    - (i) Incorporating (greenlandish)
    - (ii) non-incorporating (Turkish, Santhali, Polynesian)
    - (iii) Inflecting
      - Internal
        - (i) Synthetic Arabic
        - (ii) Analytic Hebrew
      - External
        - (i) Synthetic Samskṛta Indo-European
        - (ii) Analytic Hindī English

It should, however, be borne in mind that no language completely satisfies a single class or subclass. It has only its major structure referring to a class. Secondly, there seems a trend towards development of analyticism in languages rather than syntheticism.

The languages having non-incorporation of elements of meaning and connective structures are known as analytic languages. They do not have cases, prefixes and suffixes etc. They do not require them as they have separate words for separate meanings. Each word may have its meaning depending upon its position or order. The connective element is a separate word. There is no change or derivations in the word like *Samskṛta.* Chinese, Burmese, Thai and Tibbetan (position,

*indeclinable) are important languages of this class. Their non-*incorporating nature is also termed as analytic.

In contrast, the incorporating languages are those which have incorporation of meaning and connective structures in words, sometimes like either milk and water or seasame-rice. These languages have cases, suffixes, prefixes, derivatives etc. in the words. Majority of world languages belong to this class. The words in the incorporating languages are such that the meaning and connective elements are synthesised in them and none of the elements can be separated. The inflectional languages have these elements with some inflections in the words. The agglutinative languages have words where both the elements can be identified and they are there like sesame-rice. The structure of this type of language is simple. The human language named Esperanto and *Mānavabhāṣā* of *Satybhakta*[5] are based on this principle.

Samskṛta words illustrate the nature of the incorporating and inflectional type of languages. *Hindī* is inflectional analytic while Dravidian languages are mostly agglutinative. Some examples follow :

(i) Incorporation of connective elements completely like milk and water :

(a) *Ṛtu – Ārtava* *Śiśu – Śaiśava* *Śāli – Śāleya*
(b) *Mṛdu – Mārdava* *Diti – Daitya* *Agni – Āgneya*
(c) *Mudga – Mudgīṇa* *Nādi – Nādeya*

(ii) Inflectional incorporations like sesame-rice :

(a) *Karma – Kārmaṇya* *Dhanuṣa – Dhanuṣka*
Nikata – Naikatika
(b) *Dharma – Dhārmika* *Ākāśa – Ākāśika*
Dhenu – Dhenukā
(c) *Udupa – Audupikā* *Pāṇini – Pāṇiṇīya*
Samvatsara – Samvatsarīka

(iii) Agglutinative words
(a) *Sundaratā – sundara+tā* *Maine – Main+ne*
(b) *Karegā – Kar + e + gā*

Now-a-days, the typological classification has lost its significance. The family classification has replaced it. A family of language is based upon -- (a) linguistic similarity in words, sounds, syntax, sense and forms and (b) regional proximity. On this basis, languages of the world have been grouped under a number of families varying from one to one hundred, suggesting a difficulty in systematic grouping. However, most Indian scholars are agreed on Von Humboldt (1822) classification of languages in thirteen families[6] :

(a) Africa Zone

(i) Sematic-hematic (Inflectional)
(ii) Vantu (Aggl.)
(iii) Sudanese (Analytic)
(iv) Bushman

(b) Euresia Zone

(v) Malay-polynesian (Aggl.)
(vi) Ural-Altaic (Aggl.)
(vii) Chinese (Analytic)
(viii) Dravidian (Aggl.)
(ix) Austro-Asiatic (Aggl.)
(x) Indo-European (Inflectional)
(xi) Caucacian (Aggl.)
(xii) Japanese-Korean (Aggl.)

(c) American Zone

(xiii) Red Indian and others

(d) Pacific Zone (Polynesian)

Sematic-hematic

The world has also been linguistically divided under four zones as above where these language families are found. It is observed that the Euresia zone is most important one where some nine families are found. Some families are found even in more than one zone. The various language families are shown in Table 1.

Table 1 : Language Families and their characteristics.

1	2	3
(a) Africa Zone		
1. Sematic-Hematic (Hebrew, Arabic, Sumerian, Egyptian, Somali etc.)	Aggl.	(a) Egypt, Iraq, Arab, Syria, Algeria, Morocco (b) Libya, Somaliland, Ethiopia
2. Vantu (about 150 languages)	Aggl.	Central and South Africa, Tanzania
3. Sudanese (about 400 languages)	Analytic Isolating	African Countries surrounding HM Zone
4. Bushman		Bushman area of South Africa
(b) Euresian Zone		
1. Dravidian (Tamil, Telugu, Kannada, Malayalam, Gond, Tulu etc.)	Aggl.	South, East and Central India, Baluch.
2. Chinese (Chinese, Thai, Burmese, Tibbetan, etc.)	Isolating	China, Tibbet, Burma, Thailand, etc.
3. Ural-altaic (Finish, Hungarian, Turkish, Mongolian, Russian, etc.)	Aggl.	Finland, Hungary, Turkey, Mongolia, etc.
4. Caucasian (Georgian, Kavadian)	Aggl.	Caucasians area
5. Japanese-Korean (Japanese, Korean)	Aggl.	Japan, Korea, Nearby Islands
6. Malay-Polynesian (Languages of concerned countries)	Aggl.	SE Asia, New Zealand, Fiji, Hawai, Philip., Formosa, etc.
7. Austro-Asiatic (Santhali, Mundali, Kole, etc.)	Aggl.	East India, Cambodia, Burma, South India

1	2	3
8. Indo-European (Samskṛta, Pali, Prākṛta, Persian, Greek, Latin, English, French, German, Russian, Italian, Hindi, Bengali, etc.)	Synthetic Inflectional	India, Bangladesh, Srilanka, Pakistan, Afghanistan, Russia, Europe, USA, Canada, Australia
(c) American Zone		
1. Red Indian Languages (about 1000 languages)	Incorporating, synthetic	USA, Greenland, Mexico, etc.
(d) Pacific Zone		
Malay-polynesian languages	Aggl.	As above in 6

Family of Indo-European Languages

The Linguistics is supposed to have developed through the studies of the languages of this family specially Samskṛta. This family is, therefore, most important of all families because

(i) Geographically, its area covers larger part of the world.

(ii) It is spoken by the largest number of people.

(iii) There is larger number of dialects and sub-dialects in this family.

(iv) This family has played a dominant role in the transformation, growth and progress of the world culture, civilization, literature and education.

Geographically, this family extends from Europe, British isles upto Indian sub-continent with few exceptional areas. Because of its manifold importance, various names have been suggested for it (such as Indo-Haitti, Indo-Germanic, Indo-Keltic, Samskṛtaic, Aryan, Wires, etc.) during the course of time. But the name Indo-European still persists with least botheration

points. This family is characterised by inflectional form with suffixing nature.

This family is sub-divided into two sub-groups (one with S and the other with K oriented) consisting of ten language families as below[7] :

(a) Kentum Sub-group (K)	**(b) Satam Sub-group (S)**
1. Keltic	1. Armenian
2. Germanic	2. Volt-slavic
3. Latin	3. Albanian
4. Greek	4. Baltic
5. Tokhari	5. Indo-Iranian or Aryan

Almost all classical Indian languages like *Pāli, Prākṛta* and *Samskṛta* belong to the Indo-Aryan sub-group of Indo-European family of Euresian zone. This means that these three languages seem to be Aryan languages.

There has been a large number of varied opinions among the scholars of East and West about the original place of Aryans. However, it is now generally agreed that the Aryans originally belong to the dry south-eastern plateau of Ural mountains in Russia.[8] A good part of them moved towards the south-east to Iran and Asian countries full of green lands and prosperity while the other section moved towards the west-now called Europe. Linguistically, Grearson opines that they moved to these places in at least two groups. There was natural exchange between the languages of the immigrants and the original dwellers of the land and a conceded language gradually developed. This might have happened during 2400-2000 B. C. in Indo-Iranian case. They might have settled in India by about 1500 B. C. This could be said to be the period of start of the history of Indo-Aryan languages.

The scholars opine that this group has now three distinct but closely related sub-divisions – (i) Iranian, (ii) Dravidian and (iii) Indian. The Dravidian language belong to current Kashmir and Afghanistan. Out of these, the Darad languages form the

intermediate links between the Iranian and Indian languages.

The above description leads us to state the geneaology of main Aryan languages in this continent as below :

Euro-Asian Zone
Indo-European Family
Indo-Iranian Sub-group
Indo-Aryan Branch
Prākṛta, Pāli and Saṁskṛta

Prākṛta Language

The *Prākṛta, Pāli* and *Saṁskṛta* languages fall under the Indian sub-group of Indo-Iranian group. These are the important languages of the world. We will refer here to the *Prākṛta* language specifically.

The *Prākṛta* language is found by different names in literature. Muni Nagarāja[9] has mentioned at least ten such names from different sources including *Sthānāṅga*. Bharata has mentioned its name as *Prākṛta*. Hemacandra, Singhadeva Gaṇi, Dhanika, Nārāyaṇa, Śaṅkara and others have advocated the origin of *Prākṛta* from *Samskṛta* assuming it to be the basic language per chance predominant at their times. However, this opinion is not supported by earlier Jaina and non-Jaina scholars. Rudraṭa, Siddhasena Diwākara, Vākpatirāja, Rājaśekhara (8-9th century) and contemporary commentators like Nami-Sādhu postulate it as the earlier, native, natural and unpolished language. And therefore, this might be the philological origin of *Saṁskṛta*. This is much more logical than the earlier view. Moreover, a grammatised language cannot originate others. The current scholars express surprise, on the one hand, on the view of Hemacandra on the basis of his idea of the nativity of *Prākṛta* in his other works and on the other, they guess about his intention on the ground of time and study. *Prākṛta* means natural, simple, elegant, beautiful, pleasant and popular language.

There is, however, another opinion that *Vedic* and *Chāndas* language is the earliest and oldest literary language.

Hence, it might have either parallely developed independently or from the *Chāndas* itself. In this context, parallel development of literary *Prākṛta* seems to be more logical. Of course, when one considers the nature of language in a spoken form, it may be guessed that the literary form of *Prākṛta* might have developed at a little later date. Per chance, P. B. Pandit[10] may be right that any language has to attain an ideal *Saṁskṛta* form if it has to stay long.

The following similies support the point in question[11] :

Samskṛta	Prākṛta
1. River bridge	River bank
2. Adult virgin	Young virgin
3. Well water	River water
4. Never Young Lady	Ever young lady
5. Non-germinating	Germinating (*Apabhraṁśa* etc.)
6. —	Cupid

Prākṛta has been a common language among the common masses for a good length of time as can be judged by the dialogues in Prākṛta by the children, women, servants and other persons even in later plays of Samskṛta. Seth, along with Pischel and Woolner, also support this philological contention about Prākṛta[12]. In contrast, even Siddharṣi (10th century) states Saṁskṛta as the language of the vainly proud persons – the so called royals and literateurs[13].

Development of Prākṛtas : First and Second Stage

The development of Prākṛta is related with the movement of Aryans from the current Punjab (country of five rivers) towards Mathurā (Śūrasena) and Ayodhyā (Kośala) in the central India. The first batch of Aryans was moved towards these territories to accommodate next batch of immigrant Aryans. It is now agreed that the *Vedas* and *Chāndas* were composed in the central country. They contain the earliest Aryan language form in them. Though these Aryans had their own language, the natives of this country had also their own language. There

were eighteen such languages during the canonical period. They have also been described regionwise in three categories as — (i) Northern (Punjab Area), (ii) Central (Śūrasena) and (iii) Eastern (mostly Magadhan area). *Samavāyāṅga* and *Prajñāpanā* mention eighteen scripts rather than languages. Perchance, it is presumed that each language had corresponding script. Other canons like *Jñātādharmakathā, Rājapraśnīya, Vipākasūtra* and *Aupapātika-sūtra* also mention eighteen native languages without naming them. Perchance, they wish to follow *Samavāyāṅga*. Later books like *Kalpasūtra* commentary and *Viśeṣāvaśyaka Bhāṣya* mention eighteen scripts differently. *Lalitavistara* mentions 64 scripts having a more or less mixed nature[14].

As the Aryans had to live with these natives in different sections on their movement, their language was naturally influenced and many native words and usages became part of the Aryan language. The literary language of the *Vedas* developed out of this mutual exchange. These native languages ran parallely and have been called primary or earliest Prākṛtas by Grearson[15]. Though they have no written literature, still their existence cannot be denied. They existed in spoken form. They did not have many varieties as found when they attained the literary form. Thus, the native Prākṛtas and Chāndas are sister languages rather than parental[16]. That is why there is quite a large amount of similarity between them as shown by many scholars. One can observe large number of Prākṛta forms in the Chāndas literature. Hardeva Bahri has also summed up his conclusions similar to this description.

The period during which this process continued may roughly range between 1600-600 B. C., i.e., before Mahāvīra and Buddha. The period is designated as ancient period of Indo-Aryan languages. Literarily, this period is not very important for studies in Prākṛta.

The *Vedas* and *Chāndas* have their own languages called *Vedic* Saṁskṛta. However, the third *Veda* specially shows

more nativity than the first one. It is from this third *Veda* that the literary Prākṛta has derived many of its characteristics and constituents. The literary Prākṛta has many specialities. It has words of three types – (i) native, (ii) similar to, (iii) derived from Saṃskṛta. It has cerebral sounds. It has more simplicity than Chāndas and later Saṁskṛta in terms of (i) absence of consonants in the end, (ii) vowel sound insertions, (iii) use of long vowels in place of junctioned letters, (iv) contraction of bigger words by elimination of intermediate letters and many others.

The literary form of Prākṛta is the second stage of its development. This form is most important for the studies of Prākṛta. The native spoken language takes the shape of written form in this stage. Lord Mahāvīra and Buddha encouraged this language by adopting it as the medium of their sermons with the majority benefit approach and Saṁskṛta parallelism. They gave Prākṛta a forceful popularisation capacity.

The period of this type of Prākṛta is designated as middle Indo-Aryan period ranging from 600 B. C. to 1000 A. D. This language has developed despite grammatisation and/or systematisation of Chāndas language during this period. It has incorporated many words from Chāndas, absorbed innumerable words from native languages from north, central and eastern country. In fact, naturalism and non-systematisation led to its literary growth for the next 1600 years during which it became even the royal language for centuries (i.e., in Aśoka and Khārawela period). It represented the native culture and history of the period. This has also helped development of polished Saṁskṛta through incorporation of native words and popular subjects in it. Moreover, it became the progeny of *Apabhraṁśa* and many modern Indian languages in due course of time.

This Prākṛta developed in the central part of India extending from Śūrasena to Kośala and Magadha though the last countury[17] has been said to be non-Aryan in early days of Yāska and Śatapatha. This could be due to non-impact or least

impact of Aryans in this country. It is only later that it was included in Aryan lands.

Forms of Literary Prākṛta

The various forms of middle Indo-Aryan Prākṛta have been critically examined by many eastern and western scholars. On this basis, the development of literary Prākṛta has been classified in three stages as below with their probable periods :

(1) First Stage	Pāli and Inscriptional Prākṛtas (600 B. C. – 100 A. D.)
(2) Second Stage	Normal Prākṛta Languages (100 A. D. – 600 A. D.)
(3) Third Stage	Modern Prākṛtas (600 A. D. – 1000 A. D.)

These stages suggest its living and growing nature. It has grown in different regions of India and adopted regional characteristics leading to various forms mentioned by many authors of different periods. Linguistically, the whole period of Indo-Aryan languages is called as Prākṛta period.

The different forms of Prākṛtas mentioned are based on regions, religions, literature and dramatics. They are given below –

(a) Regional Basis

1. Bharata (300 B.C.)	7	Vāhlīka, Śaurseni, Māgadhī, Ardha-māgadhī, Avantikā, Eastern (*Prācyā*) and Southern (*Dākṣiṇātyā*)
2. Vararuci (300 A. D.)	4	Śaurseni, Māgadhī, Paiśācī, Mahārāṣṭrī.
3. Daṇḍī (600 A. D.)	4	Śauraseni, Gauḍī, Lāṭī, Mahārāṣṭrī.
4. Hemcandra (11th Century)	7	Śauraseni, Māgadhī, Paiśācī, Mahārāṣṭrī, Ārṣa (Ardha-māgadhī), Apabhramśa, Cūlikā Paiśācī.

5. Trivikrama	6	Śaurasenī, Māgadhī, Paiśācī, Mahārāṣṭrī, Cūlika Paiśācī, Apabhraṁśa.
6. Pṛthvīdhara	4	Śaurasenī, Māgadhī, Eastern, Avantikā.
7. Mārkaṇḍeya	4	Language types : 16 Sub-classes 52 Sub-classes in more details.

Language	Dialect	Apabhraṁśa	Paiśācī		Total
5	5	3	3	=	16
8	6	27	11	=	52

The Mārkaṇḍeya classification and sub-classifications are as follows :

Languages	Dialects	Apabhraṁśa		Paiśācī
1. Śaurasenī	Śakarī	Nāgara	Lāṭa	Kaikaya
2. Māgadhī	Śabarī	Brācada	Baidarbha	Śūrasena
3. Mahārāṣṭrī	Caṇḍālī	Upanāgara	Barbara	Pāñcāla
4. Avantī	Ābhirikā	Avantī	Mālavā	Kāñcī
5. Prācya (Eastern)	Takkī (Dramil)	Takkā	Kaikaya	Pāṇḍya
6. Ardha-māgadhī	Odaraj	Pāñcāla	Udra	Brācada
7. Vāhlīka	Draviḍa	Draviḍa	Pāṇḍya	Draviḍa
8. Dākṣiṇātya (south)	–	Karṇāṭa	Sinhal	Dākṣiṇātya
9. –	–	Gauḍa	Kaliṅga	Gauda
10. –	–	Madhyadesīya	Gurjara	Magadha
11.		Ābhīra	Kāñcī	Takkā
12.		Prācya	Kontala	
13.		Haihava	Takkā	

(b) Religion Basis

4 — Pāli Ardhamāgadhī Śaurasenī Mahārāṣṭrī

(c) Literary Basis

4 — Paiśācī Māgadhī Śaurasenī Mahārāṣṭrī

(d) Dramatic Basis

3 — Māgadhī Śaurasenī Mahārāṣṭrī

It seems that most of the names of these forms are regional. The native sub-forms of Mārkaṇḍeya are mostly supposed to be sub-classes of Māgadhī and Śaurasenī (Ābhīrika), Dākṣiṇātya, Paiśācī (corrupt Śaurasenī). It could, however, be seen that the Apabhraṃśa form was added to the list in later periods where many native language forms were also included in it due to later corruptions in their original forms. Similarly, it seems that Paiśācī (a tribe originally of north-west Kaśmīra) also spread through the country in east, west and south where it also adopted different forms. One also finds that there are large number of duplication of names in each category suggesting the regional forms of many dialects. This long list of forms need not surprise any body as the different regional forms belonged to the same basic language with minor differences. These were virtually dialects or sub-languages. Whatever be their number, they could all be included in the following five categories of Prākṛtas as mentioned by Tiwari[18] :

(i) Māgadhī
(ii) Ardhamāgadhī or Semi-māgadhī
(iii) Śaurasenī
(iv) Mahārāṣṭrī
(v) Paiśācī

The Literary Prākṛta of First Stage and Period

The different forms of literary Prākṛtas developed due to regional and other characters. The first stage literary Prākṛta is the most important for the studies of Jaina canons. Seth has suggested many forms of this Prākṛta :

(a) Language of Pāli literature or Pāli
(b) Language of Jaina canons – Ardhamāgadhī
(c) Jaina Mahārāṣṭrī Language
(d) Inscriptional Prākṛta Language
(e) Paiśācī and Cūlika Paiśācī Language

(f) Prākṛta of Dramas of Aśvaghoṣa

The Prākṛta of Buddhist or Jaina canons is coined by the single name of 'Archaic Prākṛta' or canonical language. They, however, seem to be quite different in origin and structure. The categories are later developmental forms. Before proceeding to Jaina canons, we will describe these Prākṛta forms in brief.

(a) Pāli Language

Many scholars agree that Pāli is the oldest form of Prākṛta. It does have only written form and no spoken form. The word Pāli for this language is a later coin-probably of fourteenth century[20]. The word Pāli has various meanings as below[21] :

1. J. Kashyapa	Paliyāya	Words, Speeches, sermons of Buddha
2. Buddhaghoṣa	Pāthā	Readings of Buddha sermons
3. B. Bhattacharya	—	Lineage
4. Maxwelsar	—	Pāṭaliputra
5. Bhandarkar et. el.	Pallī	Village Pāli (by corruption)
	Prākṛta	Pāli (by corruption)
6. Rajwade	Prākṛta	Pāli (by corruption)
7. Abhidhāna Dīpikā		Protector of meaning of Buddha
Lexicon	Prāleya	Neighbouring hilly region.

Out of these, only three valid meanings have been suggested for Pāli — (a) words, speeches and sermons of Buddha, Village or protector of the meaning of Buddha. It is the recorded language of Buddha's words and it has preserved them since centuries.

There are large number of opinions about the origin of Pāli. They can be summarised to suggest that it has not been a spoken language. It has developed as a literary and inter-provincial language based on different dialects covering the extended areas involving Magadha (Bihar), Śrāvastī (U.P.), Avantī (Ujjain, M.P.) and Janapada (Haryana). It may have predominance of

Magadhan words and usages as Budhha's sermon area was mainly Magadh. Due to political and cultural importance of Magadha, her language became lingua franca for the whole central country accomodating words and structures from many dialectical areas and Saṁskṛta.

The language of the early Budhhist literature is Pāli which has some specialities of its own. It extends from 483 B. C. to the modern age. The *Tripiṭakas* or *Sutta*, *Vinaya* and *Abhidhamma* (a little later) and many *Anupiṭakas* form the basic Buddhist canons.

(b) Inscriptional Prākṛta

This variety of Prākṛta extends from Aśokan period of 300 B. C. to about 400 A. D. The inscriptions are found in caves, pillars and coins. A large number of inscriptions are found throughout the country including Srilanka. The inscriptions of Aśoka, Khāravela (150 B. C.) and later Andhras; and central country are very important and represent different and periodically developing forms of Prākṛta with a large number of similarities among them. While Aśokan inscriptions represent Pāli-cum-Māgadhī Prākṛtas, the Khāravela and Andhra inscriptions represent old or Jaina Śaurasenī Prākṛta.

(c) Transitional Prākṛta

The transitional Prākṛta belongs to a period ranging from 200 B. C. to 200 A. D. These Prākṛta forms have been found outside India . They are contained in — (i) dramas of Aśvaghoṣa (app. 100 A. D.) obtained in Central Asia, (ii) *Dhammapada* (200 A. D.) obtained in Khotāna and (iii) Kharoṣṭhī inscriptions in Chinese Turkistan area called Neya (200-300 A. D.). While the language of the later two belongs to the west-northern India, Iran and Tokhare, the Aśvaghoṣa dramas have old Māgadhī, Ardhamāgadhī and Śaurasenī language. These dramas give these three existing old forms of Prākṛta through – (i) speeches of the wicked and low-castes, (ii) joculars and prostitutes and (iii) ascetics respectively. They represent somewhat developed

forms of Aśokan Prākṛtas. They also seem to be culminating points of the first period of Prākṛtas. Many scholars have studied them and differentiated them. *Bhāṣa* also followed Aśvaghoṣa later.

The other two forms obtained outside India are later developments of different forms of Prākṛta. We need not go into details about them here.

(d) Paiśāci and Cūlikā Paiśācī Languages

It is now agreed that Piśāca was a tribe residing in north-west Indian region. The Paiśācī Prākṛta is related with this tribe. The Cūlikā Paiśācī of Hemcandra seems to be a dialect of this form. It has many names including Bhūtabhāṣā. It is an old Prākṛta of a little later period than Pāli. It has a Śaurasenī structure influenced by Saṁskṛta together with languages of south and north-west regions of India including Kāshgara, Gāndhāra and Turkey. It does not have any noticeable independent literature. It is found in the speeches of the actors of Hemcandran drama. It is said to be of many varieties and covers a wide area of the country.

(e) Mahārāṣṭrī Prākṛta

As the name indicates, this form of Prākṛta developed in the Maharashtra region, though it has a much larger area of its adherents. Many scholars have opined it to have developed after the Śaurasenī form. This Prākṛta is literarily very rich. It has both the forms : prose and poetry. Jacobi has called it Jaina Mahārāṣṭrī as large number of Jaina texts are written in this Prākṛta. It has been influenced by Ardhamāgadhī and Śaurasenī. It has attained a standard form. It is said to be the best of the Prākṛtas. That is why this form has been the subject of Prākṛta grammars with other forms assuming a secondary comparative nature.

(f) Māgadhī and Ardhamāgadhī Prākṛta

The native language of Magadha country or Bihar and eastern India of today has been called the Magadhan Prākṛta.

Because of this area's political, cultural and overall importance in Indian tradition, this language had dominating influence over a large area. It has also been influenced by Śaurasenī of the Mathura region (of U. P.) of Mahābhārata. Some scholars opine Māgadhī's origin from Śaurasenī which might be taken to mean that it helped its development. It is surprising that such an important language existed only in spoken form and no worth-while literary work is found composed in this language. It is also seen that it was taken as the language of the low castes, women and joculars as could be guessed from drama dialogues of different periods.

The Māgadhī language is, however, characterised by the following aspects :

(i) Use of 'l' in place of 'r'

(ii) Use of palatal 's' in place of all the three -- cerebral, dental and palatal 's'.

(iii) Use of 'e' in first inflection in place of *'visarga'*.

(iv) Use of 'hu' in singular number of sixth inflection.

(v) There is use of 'ya' in place of 'ja'.

Māgadhī has various names and forms. Srilankans call even Pāli as Māgadhī. Despite the Māgadhī, the literary language turned out to be the archaic and sage spoken Ardha-Māgadhī (Semi-māgadhī) -- a standard inter-provincial medium. Lord Mahāvīra belonged to Magadha (Bihar) and Lord Ṛṣabhadeo belonged to Kośala (Ayodhyā, U. P.). Both of them are the first and the last of the torch-bearers of Jainism. They delivered their sermons in a language canonically described as Ardhamāgadhī. This is called as godly and its speakers are termed as linguistically Aryans. This is the language of the basic Jaina canons. It is surprising to learn that Vararucī has not mentioned this language -- perchance it might not be used in his times despite Bharata Muni of earlier age.

This has been defined in many sources summarised

below[22] :

(i) Ardha-māgadhī consists of half Māgadhī (by derivation).

(ii) Ardha-māgadhī represents the language of half of Magadha.

(iii) It represents the conglomerate of 18 native languages.

(iv) It is the combination of all languages.

(v) It is a pleasant and happy language which is automatically transformed into the languages of Aryans, non-Aryansand even animals.

(vi) It is the mixture of Māgadhī and many native languages.

(vii) It is the co-ordinated forms of Māgadhī and Śaurasen or Mahārāṣṭrī.

(vi) It is characterised by half the characteristics (two out of three) of Māgadhī.

It has been opined that Ardha-māgadhī originates from Ayodhyā (brth-place of Lord Ṛṣabha, U. P.) a central Kāśī-Kośala counry between Magadh and Śūrasena. Hoernle and Grearson suport the view. This means that it may be developed some three hndred years later than Śaurasenī though it has influenced it i later periods. Ardha-māgadhī has also been influenced by Saṁskṛta, neighbouring native language including Muṇḍā and Draviḍa ones. Mārkaṇḍeya, however, calls it as derived from Śaurasenī due to neighbourness. The opinion of Kramadīśvara hat original Ardha-māgadhī is a mixture of Māgadhī and Maārāṣṭrī does not seem to be correct. Of course it may represent he current canons compiled in about 453-63 A. D. It may also e true for dramas composed in western India in later dates. Theearlier Ardha-māgadhī has an eastern tinge and it has many nmes and varieties. The fact, however, is that the Ardha-māgadhas some characteristics of both Māgadhī and Śaurasenī as sown below :

Magadhi Characteristics	Śaurseni̅ Characteristics
(i) Use of 'l' in place of 'r'	Use of palatal 's' in place of cerebral or dental 's'.
(ii) Use of 'e' in place of *Visarga* in singular number of first inflection.	Use of 'o' in place of 'e'
	Use of 'g' in place of 'k'.
	Use of 'Kkha' in place of 'kṣha'.
	Use of mostly active voice

Ardha-māgadhī developed as a Lingua Franca due to its religious, royal and public patronage in Magadhan east. However, Saṁskṛta became dominant there after Mauryan period. This led its road towards west and south where it grew and we get the written forms of canonical literature. Mahārāṣṭrī also developed in west and became the standard language for Jaina compositions later.

Ardha-magadhi Literature

There is ample literature in this language spreading over many centuries. The major portion of this literature consists of Jaina canons. That is why this is called the language of (canons of) Jainas as Pāli is noted for Buddhist canons.

The Prākṛta literature has been classified[23] in three ways– (i) Period-wise, (ii) Linguistically and (iii) Literarily. The last way is most important for us. Period-wise, the literature could be classified in three classes – (i) Preliminary period (600 B. C. to 100 A. D.), (ii) Middle period (101-800 A. D.) and (iii) Modern period (600-1600 A. D.). Linguistically, Shastri has classified its eight varieties. However, literarily there are nine classes of Prākṛta literature as below :

(i) Jaina canonical literature including *ṣibhāṣita* (500-200 B. C.)

(ii) Inscriptional literature (300-150 B. C.)

(iii) Classical epics

(iv) Dramatics (100-200 A. D.)

(v) Story, Fables and Tales
(vi) Biographic Literature
(vii) Small poetic literature (*Muktaka*)
(viii) Detached proses (*Khaṇḍa kāvya*)
(ix) Miscellaneous Literature.

We will take special note for category (i) only for our discussions. It is noteworthy that Prākṛta has literature on all elegant and non-elegant subjects.

It should, however, be noted that the first period of growth of Ardha-māgadhī was followed by the period of growth of its two important forms[24] Śaurasenī and Mahārāṣṭrī – because of fall of Magadhan patronage. The Śaurasenī Prākṛta consists of mainly Digambaras pro-canonical literature like *Ṣaṭkhaṇḍāgama*, *Kasāyapāhuḍa* (100-200 A. D.), Kundakunda's literature, *Mūlācāra, Bhagawatī Ārādhanā,* etc. extending upto roughly 12th century in the central and south of the country. The Mahārāṣṭrī literature also ran parallel in the west (i. e. Ujjain and Valabhī) after the final redaction of canons during the councils in third and fifth centuries A. D. The language of this literature is not the archaic Ardha-māgadhī spoken by Mahāvīra but a mixed one having predominance of its one or other forms in regions of composition. It is also not unnatural as the literature was composed or compiled after a long time where many changes must have occurred. However, technically, canons are said to be composed in godly Ardha-māgadhī in origin. These forms of Prākṛta got national importance because of – (i) voluminous literature and (ii) religious, royal and public patronage. Moreover, the language was grammatised like Saṁskṛta in this period which led to its standard form and therefore contracted literary nature beyond general public. While this led to literary growth of Prākṛta, the native languages associated with it got their way ahead towards getting into Apabhraṁśa and then different Indian languages of today under the new Indo-Aryan chronology.

It could also be noted that the linguists prescribe the

period of Prākṛtas upto about 1000 A. D., but references are available that a variety of Prākṛta literature has been written upto the early nineteenth century. A noted Udaipur scholar is writing an epic even in these days. Secondly, despite the fact that most of the Prakṛta literature is written by Jaina ascetics and scholars, there are a number of noted non-Jaina scholars too who have contributed to the growth of this language. Mention may be made of immortal work of Aśvaghoṣa (100 A. D.), Vararuci (300 A. D.) Pravarasena, Vākāṭaka (5th. century), Vākpatirāja (760 A. D.), Kouhal (350 A. D.), Rājaśekhara (900 A. D.), Rāmpanivāda (1707 A. D.), Rudradāsa (1680 A. D.) and others. The Prākṛta language is still continuing despite its third generation in vogue. It has become one of the Degree subjects and large number of post-graduate departments in Indian Universities and Institutes are involved in researches and development related with this language.

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Chapter 2

Prākṛta Canons

All religious, philosophical, scientific and other systems in the world have some basic literature which regulates their working, followings and progress. This literature is called canons. Lexically[1], the word has been defined in traditional sense as

(a) Authentic laws of religion, spirituality, thoughts and behaviours and

(b) A list or collection of authoritative books or writings containing the above laws.

The Vedics, Buddhas and Jainas – all name these canons as *Śruta* or *Śruti* (heard) or *Āgamas* (traditional precepts). Though the term *Āgama* seems to be coined later perchance in logistic period and surfacially there seems to be no difference in the meaning of these terms, but there is a fine thread of differentiation between them. The *Āgamas* are said to be always consistent (*avisaṃvādī*) while the *Śruta* may not be sometimes so[2]. Siddhasena and Akalaṅka have pointed out the inferential and canonical consistence arising out of direct knowledge and logistics. Perchance, these scholars were the first to blow the bugle of intellectual examination and logistics in case of canons for their credibility and impressions on others[3].

The term *Śruta* has been etymological or derivative in the first instance. Apte[4] gives its meaning as general learning and holy learning. In general, it represented reading, teaching and preservation of learning by successive and traditional teacher-taught hearings and memorised communications in olden days. Later on, the term became more general in Jaina system in contrast with the Vedic system (where *Śruti* means *Vedas* only). The Jaina *Śruta* could not be written in olden

days as the process involved different types of violence and possessive attitudes contrary to ascetic rules, causing negligence and leading to atonements[5]. However, loss of memory power led to the idea of putting the *Śruta* in written form even in Āryarakṣita days (100 B. C.-100 A. D.) when he mentioned the book writing as essential effigical duty[6]. Though it was rare in those days, but it got sanctified later during 4-5th centuries.

It may be pointed out that the derivative meaning of *Śruta* referred only the heard words and their meanings. However, as it is a general form of knowledge, there are many other non-vocal and non-hearing methods using other senses like eyes, touch, body, motion, etc. in practice. They may also be included in this term. The meaning was later modified when it could include all the instrumental causes leading to produce the *Śruta*[7]. *Sūtrakṛtāṅga* mentions *Śruta* for livelihood and sainthood both[8]. Many scholars have agreed to this more generalised meaning of the term.

However, it must be agreed that though *Śruta* involves any knowledge or learning, good or bad, but as one is dealing with the spiritual and moral upliftment of the living beings, the *Śruta* leading to this direction will only be called right, superworldly or extra-ordinary *Śruta* in Jaina tradition. Thus, the term *Śruta* has now a traditional meaning in this sense. This is being subjected to critique for agreeing to its derivatively generalised meanings. The other form of *Śruta* will be termed as worldly or perverse one[9].

The term *'Āgama'* is a specific and later form of *Śruta*. The *Śruta* is a form of general knowledge while *Āgama* is a form of specific, valid and consistent knowledge given by the direct knowers. It is because of this definition that this term became prodominant over the term *Śruta* according to *Bhagavatī*[10].

However, in practice, both the terms are taken as synonymous by later tradition despite their fine differences. That is

why, *Anuyogadvāra* and *Tattvārtha-sūtra-Bhāṣyā* give a number of synonyms for these two terms. There are ten synonyms in *Anuyogadvāra*[11] and eight in *Tattvārtha-sūtra*[12] having three in common. Thus, we have fifteen synonyms in all which characterise these terms and connote the same meaning in various aspects, as shown in Table 1.

Table 1 : Synonyms for *'Śruta'* and *'Āgama'*.

1. *Śruta*	Heard from the Attained or his disciples.
2. *Upadeśa*	Instructions to learn about good or bad.
3. *Āgama*	Traditional doctrines or sacred canons containing them.
4. *Sūtra*	Abbreviated indicators, aphorisms or sacred collections.
5. *Grantha*	Treatises of sermons, collections, connecting or stringing together of sermons.
6. *Siddhānta*	Tenets or established truths.
7. *Śāsana*	Authentic controlling instructions on disciplines.
8. *Ājñā*	Jina's commandments.
9. *Vacana*	Sermons in the form of spoken words.
10. *Prajñāpanā*	Communication of sermons.
11. *Jinavacana*	Words of the Jinas.
12. *Pravacana*	Special sermons.
13. *Āptavacana*	Instructions of the Attained.
14. *Aitihya*	Traditional instructions.
15. *Āmnāya*	Sacred traditions.
16. *Śāstra*	Teaching, awakening and disciplines about constraints and preservation of culture (*Viśeṣāvaśyaka Bhāṣyā*).

The synonym *'Śāstra'* for these terms connotes all-purpose utilitarian meaning pointing :

(i) they contain rules governing the society and individuals.

(ii) they preserve the culture of the community.

However, we will be dealing with *Āgamas* rather than *Śruta* here despite the fact that they are part of the *Śruta.*

These *Āgamas* are as important to the Jainas as *Vedas* to Hindus, *Quoran* to Muslims, *Bible* to Christians, *Avestā* to Persians, *Tripiṭakas* to Buddhists and *Guru Grantha Sāhib* to Sikkhas. Besides lexical meanings of these terms, many Jaina scholars of different ages have defined them as below :

(i)	*Bhagavatī Ṭīkā*	Traditional Instructions, Religious Texts, Sacred Books.
(ii)	Malayagiri	Means of obtaining full and accurate knowledge about the objects.
(iii)	*Ratnākaravatārika*	Means of obtaining accurate knowledge about objects.
(iv)	Kundakunda	Consistent instructions of the perfect souls, defect free and omniscients.
(v)	Vīrasena (*Dhavalā*)	Dealing with supra-sensory and supra-logical objects.
(vi)	Vadidevasūri	Knowledge about the meanings and objects by the instructions of the Attained, the instructions of the Attaineds themselves.

It is seen that most of the Śvetāmbara texts and their early commentaries have not added the word Attained (*Āpta*) to define *Āgama,* though it might be pseudo-existent there. It seems to be predominantly a Digambara addition. This word has been defined by Kundakunda[13] as representing a person who is free from 18 defects* and possessed of pure attributes.

He differentiates *Āpta* from perfect souls. Samanta-

* The 18 defects are — (i) hunger, (ii) thirst, (iii) fear, (iv) anger, (v) attachment, (vi) delusion, (vii) anxiety, (viii) old age, (ix) disease, (x) death, (xi) perspiration, (xii) fatigue, (xiii) pride, (xiv) surprise, (xv) sleep, (xvi) restlessness, (xvii) indulgence and (xviii) birth. (N. S., 6)

bhadra supports this definition and calls the *Āpta* as sermoniser of *Āgamas*. However, if the sermoniser is not the Attained as qualified above, the knowledge could be attained by reasoning[14].

Perchance, Siddhasena Divākara was the first Jaina scholar who led us to the age of logic. He clearly mentioned that authentic knowledge could be obtained from two sources – (a) direct observations, inference, reasoning, etc. and (b) scriptures or *āgamas*. Jinabhadra has elaborated this by saying that ordinary cognition is obtained by determinate perception and scriptures which are *jñānas* (knowledges) rather than *pramāṇas* (organs of knowledge). This opinion is held despite the fact that Umāsvāti spoke of equivalence or synonymity of both these terms much earlier. He included the different *pramāṇas* of various Indian philosophical systems under sensory knowledge[15]. However, it was left to Akalaṅka who quotes the 'Attained' as a consistent and non-deceitful one while describing about the objects[16]. The definition seems a better generalised form than the omniscientific view of the *Śruta* . Thus, consistency and specialised knowledge became the characteristic of the 'Attained'. This way, a consistent scientist or scholar of even today may be called as Attained, in the age of logic. The definition of *Śruta* , therefore, got more generalised than the canonical age. It became more realistic and practical. To satisfy intellectuals, he called *Śruta* as authentic organ of knowledge gained through three sources —(a) direct observations, (b) intellectual reasoning associated with 'a' and (c) scriptures. The three sources were reduced to two 'a+b' and 'c' by the author of *Rājavārtika*. And thus, we have two types of authenticated and theoretical *Śruta* based on different sources.

There are quite a number of subjects whose knowledge could be authenticated by 'a+b' while there may be many subjects — say spiritual and religious where these methods cannot be applied which can be learnt through the authenticated scriptures, composed by the canonically defined 'Attaineds'. Thus, scriptures, canons or *āgamas* become important part of

the *Śruta* and their field automatically gets limited to those subjects not amenable to senses or intellect. Had this Akalaṅka version of *Śruta* been taken into account, we would have a better co-ordinated outlook regarding the balance between faith, reason and scientificity and the darker age of blind faith could be avoided and we could stand the contemporary thought processes for better knowledge. Amar Muni[17], Svami Satyabhakta[18] and other Jaina thinkers have suggested on these lines during the later half of this century.

Authors of Canons or Scriptures

It is clear from the above that the scriptures contain moral, religious or supra-sensual subjective instructions given by the all-knowing passion-winners or Jinas. They communicate them through divine speech which are organised by their chief disciples known as *Gaṇadhāras* and put in the language of common man (known as Ardha-māgadhī during Mahāvīra's period) in the forms of *Sūtras* or *Granthas*. They are explained to common man by them or later scholars. These basic *sūtras* are termed as physical canons. In addition to these, ascetics and scholars of different periods have also written a large number of authentic perceptual treatises. These are termed as pro-canons, canon-like, neo-canons or neo-āgamic texts. Some of this literature is quite old even belonging to third-fourth centuries B. C. Some of this literature may be quite later as much as 600 A. D. Many scholars presume all this literature as authentic as the canons themselves.

It is, however, found that Lord Mahāvīra is described as omniscient in early Jaina literature (*Ācārāṅga*, 2 — a later composition than 1, *Ṣaṭkhaṇḍāgama-Payadi*) though Buddhists dispute about it. It is this characteristic that led to his authenticity. His chief and remote disciples following him have placed their credibility of their compositions on his authority.

Kundakunda has defined (*Niyamasāra*, 158) omniscience from real and ideal (practical) point of view. It is only the self which is known in full reality by the omniscients. Thus,

an omniscient is a real religion-knowing person. There could be no controversy if the term is defined in this way. The extrapolated meaning of the word later as all-knowing has resulted in logical discussions through many centuries by Samantabhadra, Akalaṅka, Vīrasena and others when it became an important Jaina concept per chance due to the influence of other systems[19]. That is why it has been facing multi-directional onslaughts which has been the causes of erosion in canonical credibility during different periods. Malvania and Satyabhakta tend to support this contention.

However, looking to the current contents of canonical and pro-canonical literature, it would be more reasonable to assume that :

(i) The canons are not directly authored by Mahāvīra. They have been compiled or composed by his chief disciples (Gaṇadharas) or remote followers on his authority. The primary canons called *Aṅgas* are composed by chief disciples and the pro-canons called *Anaṅgas* are composed by remote disciples.

(ii) The canons and other scriptures have been composed/collected at different periods after Mahāvīra as suggested by Dixit[20] and others.

(iii) The available canons contain records of thoughts, precepts on different aspects of human activities like religion and physical phenomena. Dixit has, therefore, suggested that they should be viewed with historical perspective as a means to learn about the process of gradual development of Jaina thoughts and concepts. This perspective has a capacity to give us a reasonably broader outlook to evaluate the Jaina contribution in different fields of knowledge and verify its position. This is comparatively better than the traditional perspective. Vijaya Muni had also expressed similarly[21].

Gautama Svāmī or Sudharmā Svāmī — the chief disciples of Mahāvīra are said to compile the basic canons while many pro-canons have been written by other *ācāryas*. Table 2

gives the current state regarding the authorship and period of different canonical and pro-canonical books. This may not be very accurate but it will give some idea about the authors and their approximate periods.

Table 2 : Assigned authors and periods of composition of canons/pro-canons.

Canon/Pro-canon 1	Author/Compiler 2	App. Period 3
1. *Dṛṣṭivāda*	–	Pre-Mahāvīran period
2. *Daśavaikālika*	Sayyambhava	452-429 B. C.
3. *Āvaśyaka-sūtra*	Compiled	527 B. C.
4. *Uttarādhyayana*	"	350-250 B. C.
5. *Ṛṣibhāṣita*	"	500-300 B. C.
6. Ācārāṅga	Sudharmā Svāmī	400-300 B. C.
7. *Sūtrakṛtāṅga*	"	300-200 B. C.
8. *Cheda-sūtra, Niśītha*	Bhadrabāhu-I	350 B. C.
9. *Daśāśruta, Vṛhatkalpa*	"	"
10. *Vyavahāra*	"	"
11. *Vyākhyā Prajñapti*	"	200-100 B. C.
12-13. *Sthānāṅga/Samavāyāṅga*	Compiled	100 B. C.-300 A. D.
14. Six Narrative Canons	"	100 B. C.-400 A. D.
15. *Prajñāpanā*	Ārya Śyāma	190-150 B. C.
16. *Jīvābhigama*	–	100 B. C.-100 A. D.
17. Current *Praśnavyākaraṇa*	–	700 A. D.
18. *Niryuktis*	Bhadrabāhu-II	400-500 A. D.
19. *Nandī Sūtra*	Deva Vācaka	App. 500 A. D.
20. *Anuyogadvara Sūtra*	Āryarakṣita	100 B. C.-100 A. D.
21. *Jitakalpa*	Jinabhadra	600 A. D.
22. *Mahāniśītha*	–	700-800 A. D.
23. *Catuśśaraṇa* etc.	Vīrabhadra	950 A. D.

Though the different basic canons are supposed to be based on the sermons of Lord Mahāvīra, but their written forms

seem to have developed later, per chance by the second council in Mathurā or Valabhī, many of pro-canons are also compilations as no author is mentioned for most of them. It is nearly by the beginning of the Christian era that we begin finding names of authors of many books in the above list.

Linguistical Period of Canonical Composition

The Jaina canons and pro-canons as available today are composed in Ardha-māgadhī, Śaurasenī and Mahārāṣṭrī Prākṛtas. These languages represent different periods of their development. Thus, the literature composed in these languages should also have different periods of compositions. The basic Jaina canonical literature covers a period of roughly one thousand years after Mahāvīra. This is the literature which will be taken into account for the purpose of this study. It must be added, however, that the Buddha *Tripiṭakas* were collected and written much earlier than the Jaina canons. Hence, linguistically they represent better antiquity.

Classification of Śruta or Jaina Canons

(a) *Aṅgas* and *Pūrvas* and

(b) Primary and Secondary Canons.

The basic Jaina *Śruta* or *Āgama* is in the form of twelve sacred books called *Nirgrantha Pravacana* (Sermon of the Jaina Saints) in canonical books. The earliest part of the first two holy books mention the terms *'Śruta, Śrutadharma, Śruta-sthavira, Śrutakevalī, Śrutadhara'*, but they do not have any description about Jaina *Śruta*. Despite naming 14 *Pūrvas* in chapter 14, even *Samavāo*, chapter 2 and 12 do not mention the *Śruta* variety. Strangely enough, it describes their contents in its miscellany. *Bhagavatī* also makes a confusing reference about eleven *Aṅgas* and 14 *Pūrvas* beginning with *Sāmāyika* (*Ācārāṅga*)[22]. However, the later compendium of *Sūtrakṛtāṅga* (2. 1. 35) mentions 12 *Aṅgas* and *Sthānāṅga* (2. 104) mentions the two-way *Śruta* classification alongwith ten synonyms of *Dṛṣṭivāda*. These later additions suggest that the classification

of Jaina *Śruta* took place sufficiently later when the Jainas had to face challenges from Vedic, Buddhists and other existing philosophers. Their elder scholars of the day organised the oral tradition in texts by authentication from the Jina's in contrast with the divine Vedas and other older philosophies. That is why the classification excels numerically in all text classes. This could be assumed to have taken place in about 350 to 200 B.C., i.e. sufficiently later than Mahāvīra. And since then, despite many later classifications, the two prong classifications persist. This leads us to infer *Ācārāṅga* 1, *Sūtrakṛtāṅga* and some *Bhagavatī* portions (possibly 1-20) to be older than the age of classification.

Currently the basic and major part of Jaina canon is called twelve member teacher-basket — *Dvādaśāṅga Gaṇipiṭaka* in consonance with Buddha's *Tripiṭakas.* However, the term *'Aṅga'* is current today which could be in consonance with six Vedāṅgas (auxiliary to Vedas) and nine or twelve Buddhists *Aṅgas* (sermons and narratives in different styles). Contrastingly, the *Aṅgas* of Jainas are the main, not auxiliary and they form a composite unit. Traditionally, they were collected out of memory and classified during the first council of Pāṭaliputra during Bhadrabāhu-1 time (376-335 B. C.) after an acute 12-year famine. This compilation seems sufficiently later (about 160 years after the salvation of Mahāvīra) in comparison to Buddhas who compiled their canons barely 49 days after his death. The non-Indian religions have a three day compilation period. However, *Sūtrakṛtāṅga* and *Bhagavatī* mention them under the extent learnings of the day[23]. Thus, the Vedas and Buddhists canons seem to have better antiquity with reference to composition and linguistics.

Though *Sthānāṅga* mentions *'pūrvagata'* (*Pūrva*) as the synonym of *Dṛṣṭivāda,* it seems that this was the first traditional canonical collection which Mahāvīra might have inherited. Looking to its voluminous doctrinal contents and historical importance, the *Pūrvas* were taken to be the separate class by

themselves. That is why *Samavao* mentions them in chapter 14. Thus, Devendra Muni suggests the first classification of Jaina canons in terms of *Aṅgas* and *Pūrvas*[24]. Ācārya Tulsi also supports it. Not only this, the knower of the *Pūrvas* had the most respectable position.

However, when Mahāvīra established and systematised his church, the *Pūrvas* were included in his twelve *Aṅga* system as part of the twelfth *Aṅga* and thus, *Aṅgas* became the chief canons of Jainas and *Pūrvas* were submerged.

There were many treatises authored by direct, remote or other disciples or elderly scholars (*Sthaviras*) and followers of Mahāvīra whose contents were based on canons, hence consistent and authentic. They were also treated as canon-like. But they could not be added to the *Aṅgas* as their number was fixed. Hence a separate category of pro-canonical texts was thought of. And *Sthānāṅga,* thus, has a second two-fold classification in terms of : (i) *Aṅgas* or basic or primary texts and (ii) *Anaṅga, Aṅgabāhya,* pro-canons or secondary texts. This has been followed by scholars and *ācāryas* of all the Jaina sects. They have suggested that even the *Anuyogadvāra* of first century A. D. does not have this classification. It is only in *Nandī* (5th century) that this dual classification with its contents is observed[25]. It could, therefore, be surmised that the current accepted classification might have been evolved during 100-400 A. D.

There is one more classification different from the above in *Mūlacāra* and *Ṣaṭkhaṇḍāgama*[26] — the noted Digambara texts. They have three types : (i) Worldly, (ii) Vedic and (iii) Spiritual or *Sāmāyika.* Though there is some difference in their elaboration, but they include current subjects of humanities and science, Vedas and Indian philosophies and the twelve *Aṅga* system of Jainas. *Sthānāṅga* gives these three categories in terms of professions. The basis of this classification is not clear, but it represents a liberal attitude of the Jainas towards the credibility of non-Jaina, non-spiritual literature of that period.

However, it may be noted that *Ṣaṭkhaṇḍāgama* has followed in some way the *Anuyogadvāra Sūtra*.

Anuyogadvāra and *Nandī-sūtra* have classified the *Śruta* on the basis of generalised definition of the term. They unfold the manifold character of *Śruta* as given in the Table 1. The older *Anuyogadvāra* uses the four-fold positing method where its last form — the actual *Śruta* is pertinent to us here. This could be canonical or quasi-canonical. It has worldly and superworldly types. The basic twelve are designated as actual quasi-canonical superworldly type in contrast to the worldly one including different arts, sciences and philosophies. Pro-canons are not mentioned here. The *Nandī-sūtra* mentions 14 while Devendrasūri goes upto 20 types. The canons and pro-canons are included in right *Śruta* while others are called wrong or perverse *Śruta*. The *Anuyogadvāra* calls them superworldly and worldly respectively. It should be taken that the right category of *Śruta* of *Anuyogadvāra* includes the 13-14th category of *Nandī*. This classification is easier and it avoids positing basis of *Anuyogadvāra*. However, on comparing, it is seen that the following category of couples :

(1-2) Right and wrong *Śruta*

(3-4) *Aṅga* and no-*Aṅga* or primary and secondary *Śruta*

fall under the actual positing while other couples fall under substantial positing. Three points may be noted here :

(i) While *Anuyogadvāra* refers to 12- *aṅgas* as of quasi-canonical superworldly category, *Nandī* mentions them under right category which also includes secondary *Śruta* not mentioned in *Anuyogadvāra*. This suggests that the secondary canon might not have gained recognition by the period of *Anuyogadvāra*. The terms worldly and super-worldly should be taken in terms of objectives of the writings. This is reasonable to assume primary texts as extra-ordinary as they direct us towards moral and spiritual upliftment in comparison to the troublesome and temporary worldly prosperity. Thus, the right

Śrutas are extra-ordinarily merit-promoting compositions.

(ii) *Nandī*[27] has 25 general, perverse worldly or demerit-promoting *Śrutas* in place of 19 in *Anuyogadvāra.* Of course, 72 arts and four Vedas are additionally common in both cases. *Nandī* has added seven (Maths, Patañjala, Puśyadevata, Prognostics, Bhāgavata, Scriptology and rule of three or Ājīvaka) and substracted one (Science of love and livelihood). Despite different names (wrong, worldly or demerit-promoting), they should be taken as synonymous on the basis of their contents.

(iii) *Nandī* is liberal in pointing the view that even the perverse *Śruta* could be right for the right-faithed and perverse-faithed who is encouraged to attain rightness in faith and action through their contents. This point is suggestive of liberal and non-dogmatic attitude of the Jainas in *Nandī* days when Siddhasena was also heralding the age of logic.

The two categories of right *Śruta* are still maintained. There is no sub-classification of the primary twelve. But the secondary texts are sub-classified in different ages from *Sthānāṅga* to *Vidhimārgaprapā* (Jinaprabha, 1270-1330 A. D.) and the number of these texts have also got varied. *Nandī* mentions 60 texts in this category. Currently, it has about 73. In contrast, the Digambaras have only 14 texts in this category (10 common and four specific). They are given in table 3. The *Nandī* list seems to be a mixed one when it is compared with the current and systematic classification of later dates (per chance after fourteenth century A.D.). This has the following six categories :

Table 3 : Primary and Secondary Texts of Jainas.

[A] Śvetāmbara Sect

1. Primary or *Aṅga* texts	11	11	11	*Dṛṣṭivāda* being lost out of twelve.
2. *Upāṅgas*	12	12	12	They are called so but there seems to be no co-relation with *Aṅgas.*
3. *Mūlasūtras*	–	–	6	Texts of indispensable duties/recites.

4. *Chedasūtras*	–	–	6	Texts of atonements.
5. *Cūlikā Sūtra*	2	–	–	Classified description about methods of studies and knowledge.
6. *Prakīrṇakas* (timely/trans-timely)	49*	9	10	Small texts on different religious subjects (Miscellaneous).
Total	84*	32**	45***	

[B] Digambara Sect

1. Primary Texts	12	(*Dṛṣṭivāda* sub-classification makes a total of 52)
2. Secondary Texts	14	

It is clear that the number of texts in right *Śruta* category varied with respect to times and development of different sects. However, only the twelve are auto-authentic while others are non-self-authentic. The secondary texts included in this description are varying in number and many of them were composed much later than the classification was proposed.

Canons

Anuyogadvāra

(i) Namal
(ii) Representational
(iii) Substantial
(iv) Actual

Actual canons | Quasi-canons

Quasi-canons: Worldly 19 | Super-worldly 12

Nandī

Seven pairs : 1. Lettered, 2. Non-lettered, 3. Instinctive, 4. Non-instinctive, 5. Beginningful, 6. Beginningless, 7. Ending, 8. Non-ending, 9. Repeatory, 10. Non-repeatory, 11. Right, 12. Perverse or Wrong, 13. Primary or *Aṅga*, 14. Secondary or no-*Aṅga*.

* Idol worshiphers ** Terāpanthis *** Others.

There has been a disquisitional (*Anuyoga*) classification of the canons by Āryarakṣita (100 B. C.-100 A. D.) on the basis of the subject-matter of the canons. This could not be taken as important as almost all the primary canons have varied subjects and they could not be classed in one or the other disquisitions. This classification is only of historical importance. However, many books have been composed later which could be easily codified under this classification. This has not been mentioned by different scholars like Umāsvāti, Kundakunda, Pūjyapāda and others though some post-Christian authors mention it.

Whatever be the classification, the primary and secondary texts under eight *Śruta* will be the main source for our studies here.

Descriptions of Canons

(a) Pūrvas or Pre-canons — There is a difference of opinion about the word *'Pūrva'* (earlier) whether it represents the pre-primary literature of Mahāvīra himself who delivered the *Aṅgas* in simple language for the laymen or the Pārśvaic sermons. Schubring[28] opines that the two types of literature existed parallely and independent of each other. The supposed origin of different canonical *Aṅga* texts from the *Pūrvas* should be taken merely as relationship in contents as exemplified below :

1. *Satyapravāda Pūrva*	*Daśavaikālika,*	7 (*Vākyaśuddhi*)
2. *Ājñānuvāda Pūrva*	"	3 (*Dharmaprajñapti*)
3. *Karmapravāda Purva*	"	5 (*Piṇḍaiṣaṇā*)
4. *Pratyākhyānapravāda Pūrva*	"	(Other Sections)
5. *Karmapravāda Pūrva* Sec. 20	*Cheda-sūtra,*	Daśā, Kalpa, Vyavahāra etc.
6. *Āgrāyaṇī Pūrva* (Part)	*Ṣaṭkhaṇḍāgama*	
7. *Jñānapravāda Pūrva* (10th section)	*Kaṣāyapāhuḍa*	

Jaina scholars, however, presume the *Pūrvas* are the ancient existences dealing with philosophical and epistemo-

logical subject not easily intelligible by layman. Fortunately, these do not exist today, though one finds references towards their size and contents in literature as shown in Table 4.

There are fourteen *Pūrvas* and all but four (1, 2, 11, 14) have their names ending in *Pravāda* (discussion on specific controversial subjects). This gives us some idea regarding their intellectual and heretic nature. The Jainas wanted to refute their contents. However, Schubring[29] goes too far when he says that the most of the *Pūrvas* are obscure and speak in favour of their fictitive nature.

The Śvetāmbara and Digambara versions about them are not very different in their descriptions except names of the (11, 12) *Pūrvas* and size of two (8, 12) *Pūrvas*. The variance in names is not so substantial but size differences are large. In case of eighth *Pūrva*, there may be a copying mistake. This could be rectified. In case of twelfth, the difference is too large-too complex to be resolved. Moreover, the size of the *Pūrvas* is very irregular in comparison to the *Aṅgas* as shown later. Despite this, there seems to be some difference between the two versions. For example, Table 4 suggests that :

(i) Śvetāmbara version does not have *Prābhṛts* and *Anuyogas* in the *Pūrvas*.

(ii) In contrast, the Digambaras do not have *Cūlikās* in their details.

(iii) Despite the individual number of Sections (*Vāstus*) being different in both versions, the total of them is nearly the same.

(iv) The contents of *Pūrvas* are given only in Digambara texts.

The tabled contents of the *Pūrvas* suggest that they did contain the same material as contained in the *Aṅgas*. They are supposed to be all inclusive. These were taken to be so important (as well as voluminous) that a separate *Aṅga* was thought of to include them alone or alongwith other of its

Table 4 : Details of Pūrvas or Pre-canons : Contents and Size.

Name	Padas	Vāstus[1]		Prābhṛts*[2]	Anuyogas*	Culikās**	Contents*
1	**2**	**3**	**	**4**	**5**	**6**	**7**
1. *Utpāda Pūrva*	1,00,00,000	10	10	200	4800	4	Origin, decay, permanence of substances, five practices
2. *Agrāyaṇī Pūrva*	96,00,000	14	14	280	720	12	Substances, modes, 363 philosophic systems, 700 good / bad viewpoints
3. *Vīryapravāda*	70,00,000	18	18	160	3840	8	Six types of internal energy of systems, accomplishments
4. *Astināsti-pravāda*	60,00,000	18	18	360	8640	10	Polyviewism
5. *Jñānapravāda*	99,99,999	12	12	240	5760	–	Description about 8 knowledges
6. *Satyapravāda*	1,00,00,006	12	2	240	5760	–	Description about truth, speech, language and its rules
7. *Ātmapravāda*	26,00,00,000	16	16	320	7680	–	Description about soul, consci-ousness, living.

1	2	3		4	5	6	7
8. *Karmapravāda*	1,80,00,000 1,00,80,000**	20	30	400	9,600	–	Theory of eight *Karmas*
9. *Pratyākhyāna-* pravāda	84,00,000	30	20	600	14,400	–	Renunciation, Atonement, Aspects of good conduct.
10. *Vidyānu-* *pravāda*	1,10,00,000	15	15	300	7,200	–	Different types of Learning, Sciences, Accomplishments
11. *Kalyāṇa Pra-* *vāda* (*Avandhya Pūrva*)	26,00,00,000	10	12	200	4,800	–	Prognostics, Astronomy, Stories of greatmen
12. *Prāṇāvāya P.* (*Prāṇāyu P.*)	13,00,00,000 1,56,00,000**	10	13	200	4,800	–	Ayurveda, Medicines (Senses, Respiration, Demonology, etc.)
13. *Kriyāviśāla*	9,00,00,000	10	30	200	4,800	–	72 arts, 64 arts for women, poetics, prosody, etc.
14. *Lokabindusāra*	12,50,00,000	10	25	200	4,800	–	Maths, Best accomplishments, Salvation methods and bliss
	95,50,00,005	195	194	3,900	93,600	34	

* Digambara Version ** Śvetāmbara Version 1. Sections 2. Chapters

varieties. As pointed out earlier that *Pūrvas* became a major part of the primary twelfth *Aṅga* in later classification.

On going through the contents of the *Pūrvas,* one finds many *Pūrvas* (1, 2, 10, 12, 13, 14) did have contents or concepts regarding physical world and its different phenomena. How best it could have been if *Pūrvas* could be available today. The history of science could have a different course of progress in that case. Per chance, the loss of *Pūrvas* (or the twelfth *Aṅga* in general) could be attributed to the two facts :

(i) Its contents had much material for science of incantation, ritual and amulets which was not in tune with Mahāvīra's teachings.

(ii) The heretic disputations contained in different sections could arouse discussion in Mahāvīra's church. This position was undesirable and its preservation was overlooked. This fact is also mentioned by Jacobi and Schubring.

The *Pūrvas* seem to have been available in native Prākṛts of early days-though not in Ardhamāgadhī which is a somewhat developed form. They could not be in Saṃskṛta, as some say, as it could not be the language of the mass in the days of Pārśva.

(b) Primary Canons or Aṅgas

The post-Mahāvīra canons are called Primary *Aṅgas* (members or limbs) or *piṭakas* (baskets) the former being most prevalent in contrast with the term *Pūrva* for the Pārśvan archaic literature. There are twelve books agreed by both sections of the Jainas. Their basic names are given in Prākṛta but we will use the Saṃskṛta names for simplicity. There is some difference among the various names of the *Aṅgas* in different versions but it is very minor and may either be overlooked or unified in current age. The numerical twelve has been explained in *Abhidhāna Rājendra Kośa* (a lexicon) and *Nandī Cūrṇi.* It suggests that the scripture as a whole is like a scripture-man who has twelve major parts in his body like human body

as given by Malaygiri[31] :

2 feet	*Ācārāṅga* and *Sūtrakṛtāṅga*
2 hands	*Anuttaropapātika* and *Praśnavyākaraṇa*
2 thighs	*Sthānāṅga* and *Samavāyāṅga*
2 knees	*Vyākhyāprajñapti* and *Jñātādharmakathā*
2 body-halves	*Upāsaka* and *Antakṛddaśā*
1 Neck	*Vipāka-Sūtra*
1 Head	*Dṛṣṭivāda*

This personification of *Śruta* suggests its basic importance for human upliftment.

The details of these twelve canons are given in Table 5 a according to both the sections where *Samavāo* order is followed. This description is somewhat different from *Jaina Sāhitya Sanśodhaka,* Vol.1, p. 108 and is based on Journal of Bhandarakar Oriental Research Institute referred by Doshi[32]. The Digambaras have only the description about contents and the number of *padas* (1/4 *gāthā* of 32 letters). In contrast, the Śvetāmbaras have more details about the sections, chapters and sub-chapters in addition. We find that there is a good amount of difference in the number of *padas* found in both the versions, specially in the 6-11 *Aṅgas.* The Śvetāmbara version had the *padas* in terms of numerable thousands or lacs (N T or N L) while the Digambaras have them by definite numbers. Despite the fact that both the versions agree on the memorical loss of *Dṛṣṭivāda* only, the Digambaras give the number of *padas* for it. It has been suggested that the mention of number of *Padas* of every *Aṅga* (or for any text) was necessary for making payments to the copiers[33].

Besides *Dṛṣṭivāda,* there is also something to be said about the tenth *Aṅga* – *Praśnavyākaraṇa,* the current form of which does not conform to the contents in *Samavāo.* It is felt that the available version is a sufficiently later corruption. One is, therefore, unable to justify its present inclusion and enumeration in the *Aṅga* canons. It may satisfy the tradition but not

the intelligent mind of today. The contents of this *Aṅga* included astronomy, astrology, prognostics and the like. This was felt against the Jaina tenets. Hence the new contents were substituted. They can not be original. The matter requires serious consideration. Why this could not be taken as lost like *Dṛṣṭivāda* ?

(c) Secondary, Supplementary or Aṅgabāhya Canons

The third series of Prākṛta canons are called supplementary ones. They consists of five groups. They are detailed in Table 5 b. Many of them are as old as basic canons but quite a number of them are of later composition. The first group is called *Upāṅgas* – a term coined not earlier than seventh century. Each *Aṅga* is said to have an *Upāṅga.* Their contents are varied and involve didactic stories, legends, Jaina mythology and metaphysics, many topics related with physical phenomena, astronomy, astrology and others. The other groups also reflect a variety of contents for the laymen and ascetics. The details of these groups indicate their variety of size reflecting their volume. Many of these books are useful for this study in different contexts. However, it must be pointed out that Digambaras do not have this much number and variety of secondary canons. They have only 14 as said before and named below :

(i) *Sāmāyika,* (ii) *Caturvimśatistava,* (iii) *Vandanā,* (iv) *Pratikramaṇa,* (v) *Daśavaikālika,* (vi) *Uttarādhyayana,* (vii) *Kalpavyavahāra,* (viii) *Kalpyākalpa,* (ix) *Mahākalpa,* (x) *Niśīthika,* (xi) *Vainayika,* (xii) *Kṛtikarma,* (xiii) *Puṇḍarīka* and (xiv) *Mahāpuṇḍarīka.* The equivalents of 1-10 are in the earlier list (Table 5b E) while 11-14 are specific. *Dhavalā* (1. 1. 2, p. 98) describes the contents of these books. The last four describe humble conduct, method of worship, religious activities and penances leading to higher human status. The first ten have similar contents as in Table 5 b.

It is noteworthy here that the sizes of these supplementary canons are fairly reasonable in comparison to the primary canons.

Table 5 a : Details of Primary Jaina Canons or Aṅgas.

Name	Padas (S)	Padas (N)	Padas (D)	Padas (Current)	Details	Chapters	Sub-chapters	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. *Ācārāṅga*	18,000	18,000	18,000	2644–54	2	25	85	85
2. *Sūtrakṛtāṅga*	36,000	36,000	36,000	2100	2	23	33	33
3. *Sthānāṅga*	72,000	72,000	42,000	3750–70	1	10	21	21
4. *Samavāyāṅga*	1,44,000	1,44,000	1,64,000	1667/1767	1	101	–	–
5. *Vyākhyāprajñapti*	84,000	2,84,000	2,28,000	15800/16000	1	100	100^2	10^4
6. *Jñātādharmakathā*	5,76,000	N. T.	5,56,000	5500–6000	2	19	29	29
7. *Upāsakadaśā*	N. L.	N. T.	11,70,000	812–912	1	10	10	10
8. *Antakṛtadaśā*	N. T.	N. T.	23,28,000	900	1	8	10	10
9. *Anuttaropapātika*	N. L.	N. T.	92,44,000	192	3	33	10	10
10. *Praśnavyākaraṇa*	N. L.	N. T.	93,16,000	1250	1	45	45	45
11. *Vipāka-sūtra*	N. L.	N. T.	1,84,00,000	1250	2	20	20	20
			4,15,02,000					

1	2	3	4	5	6	7	8	9
12. *Dṛṣṭivāda* (D)								
(a) *Parikarma*								
i) *Candraprajñapti*	–	–	36,05,000					
ii) *Sūryaprajñapti*	–	–	5,03,000					
iii) *Jambūdiva Paṇṇatti*	–	–	3,25,000					
iv) *Dvīpasāgara Pra.*	–	–	52,36,000					
v) *Vyākhyāprajñapti*	–	–	84,36,000					
(b) *Sūtra*	–	–	88,00,000					
(c) *Prathamānuyoga*	–	–	5,000					
(d) *Cūlikā*								
i) *Jalagatā*	–	–	2,09,89,200					
ii) *Thalagatā*	–	–	2,09,89,200					
iii) *Māyāgatā*	–	–	2,09,89,200					
iv) *Rūpagatā*	–	–	2,09,89,200					
v) *Ākāśagatā*	–	–	2,09,89,200					
(e) *Pūrvagata* (Table 4)			95,50,00,005					
			1,08,68,56,005					
Total Padas			1,12,83,58,005					

1	2	3	4	5	6	7	8	9
12. *Dṛṣṭivāda* (S)	N. L.	N. T.	–					
(a) *Parikarma*	7							
(b) *Sūtra*	88							
(c) *Anuyoga*	2							
(d) *Cūlikā*	4							
(e) *Pūrvagata*	14 (See Table 4)							

(S) : *Samavāyāṅga Vṛtti* Basis (N) : *Nandīsūtra Vṛtti* Basis (D) : Digambara Scriptures
N. L. : Numerable Lacs N. T. : Numerable Thousands Pra. : *Prajñapti*

In *Samavāyāṅga Vṛtti*, N. T. and N. L. are given in numbers similar to Digambaras with some differences. No details about *Padas* are available for four *Dṛṣṭivāda* forms in Śvetāmbara version.

Table 5 b : Details of Secondary Canons, Pro-canons or *Aṅgabāhyas**.

Pro-canons	Sections	Current Size (Ślokas)	Contents
1	2	3	4
[A] Upāṅgas	12		
1. *Aupapātika*	2	1167–1500	Didactic Stories
2. *Rājapraśnīya*	2	2019–2509	Didactic Stories

1	2	3	4
3. *Jīvābhigama*	9	4700–5200	Description regarding living
4. *Prajñāpanā*	36	7787–8100	Description under many heads
5. *Sūryaprajñapti*	20	–	The world of Sun
6. *Jambūdvīpa Prajñapti*	7	4146–4458	The world of Jambūdvīpa
7. *Candraprajñapti*	7	2058	The world of Moon
8.- 12. *Nirayāvalikā*	5	1109	Didactic stories
[B] Mūlasūtra	**6**		
1. *Uttarādhyayana*	36	2000–2300	Legends, Kesī-Gautama, Tenets
2. *Daśavaikālika*	10	700	Fundamental Principles, Asceticism
3. *Āvaśyaka*	6	–	Six Indispensable essentials
4. *Piṇḍa Niryukti*	–	7691	Alms and food rules
5. *Ogha Niryukti*	–	1154–1460	Conduct classifications, 70
6. *Pākṣika Sūtra*	–	–	Major vows, liturgy, worship
[C] Cheda Sūtra	**6**		
1. *Niśītha*	6	812	Violatory atonement and penances
2. *Mahāniśītha*	20	4544	Atonements and Narratives
3. *Vyavahāra*	6	–	Prescriptions and Interdictions
4. *Daśāśruta (Kalpa-sūtra)*	10	1596	Disciplinary regulations

1	2	3	4
5. *Vṛhatkalpa*	6	400	Discipline, Mahavīra's Life
6. *Jitakalpa*	–	103–105	Violatory disciplines
[D] Cūlikās	**2**		
1. *Nandī*		700	Theory of Knowledge
2. *Anuyogadvāra*		1399–2005	Classified descriptions
[E] Prakīrṇakas	**10 - 39**		
1. *Catuśśaraṇa*		63	Four-fold refuge
2. *Candravedhyaka*		174–175	Renunciations by the sick
3. *Ātura Pratyākhyāna*		84	Behaviour at the time of death
4. *Mahāpratyākhyāna*		142–143	Confessions, Renunciations
5. *Bhakta Parijñā*		173	Dispensing with food
6. *Taṇḍula Vaicārika*		400	Embryology, Women condemnation
7. *Gaṇividyā*		75–86	Astrological concepts
8. *Devendrastava*		292–307	Celestials descriptions, liturgy
9. *Maraṇasamādhi*		–	Method of voluntary death
10. *Sanstāraka*		121	Pallet of Straw, legends
Many others are also there			

* Doshi, Bechardas : Jaina Sahitya Ka Brihad Itihasa, Vol. 1, P. V. R. I., Varanasi, 1966.

Magnitude, Size or Volume of Primary Canons

(a) Physical size — The magnitude of any text could be expressed in two ways — (i) physical size and (ii) subject content. The physical size of the primary canons including *Pūrvas* has been expressed in terms of number of *Padas* (1/4 verse, *gāthā* or *śloka* of 32 letters). They are sometimes expressed by the authors and mostly by the copiers for their payments.

Of course, we do not find any definition of term *Pada* in canons and pro-canons. It is, however, found in texts of later dates. Many scholars[34] have defined it as a collection of meaningful words or letters without quantifying it. Per chance *Jaidhavalā*[35] seems to be the first to quantify the term. Accordingly, *pada* has three forms :

(i) Meaningful *pada* consists of as many letters and words as may carry a gainful meaning. This form is the same as defined by early scholars.

(ii) The metrical *pada* consists of one-fourth of the whole verse in a particular meter and, therefore, one-fourth the number of letters in that meter. As in the days of canons, *gāthā* or *anuṣṭup ślokas* were common meters, the *pada* normally could mean a group of eight letters. This seems to be the most relevant quantitative definition of *pada.*

(iii) The medium *pada* seems to be rhetoric consisting of 1634, 8307, 888 letters. Before actually defining it, Nemichand Chakravarti points out *'pada'* containing numerable letters.

It has been suggested that the canonical *'padas'* mean the medium *'padas'*. If this is agreed, one could easily calculate the number of letters contained in *Ācārāṅga* 's 18,000 *padas.*

18,000 × 16,34,83,07,888 = 29,42,69,54,19,84,000
= 91,95,92,38,17,000 *ślokas* of 32 letters.

If a normal book is taken as a 600 page book containing 36 lines of 32 letters each, the *Ācārāṅga,* alone, will be equivalent to forty-two crore fifty-seven lacs thirty-seven thousand and

one hundred eighty five books, an unimaginable figure

29,42,69,54,19,84,000/ 32 x 36 x 600
= 42,57,37,184.5 books

In contrast, if the *anuṣṭup*-meter-based definition of eight letter *'pada'* is taken into account, we have a book of 125 page for *Ācārāṅga* which is a reasonable size :

18,000 x 8 = 144,000/ 32 x 36 = 125 page

Thus, one should agree to a *'pada'* definition as a 8-letter unit. The current size of *Ācārāṅga* is roughly 2650 *ślokas* or 10,600 *padas.* This means that approximately 40% of the original text seems to be lost in memory at the time of its putting into writing, i.e., during about 1000 years after Mahāvīra. Devendra Muni says that this is not surprising as this has happened in case of Vedic and Buddhists literature too. However, it must be pointed out that :

(i) The concept of *Madhyama pada* is a heavy extrapolation and mythological. It should be discarded for describing the size of canons. Comparatively, it is seen that the Jainas have been master extrapolators in almost all descriptive aspects which could be confirmed from the Table 6.

In a sense, all descriptions regarding visible aspects of the universe should be made reasonable and reliable. Malvania, Amar Muni, Satyabhakta and others have expressed the imaginary and unverifiable nature of these types of magnitudes. This author inquired personally from many saints and scholars regarding the canonical size but all kept mum on the issue except one[36] who explained the issue on the physical and psychical basis. Psychically, the *Śruta* may have an infinite magnitude. The credibility of this point is teasing to the scientific mind.

(ii) The metric *pada* of 8-letter should be the basis of canon size computations. However, even on this basis, the other *aṅgas* may not fare well. Looking to their current size as shown in Table 5 a, their memory loss may be very high. Take for example, the case of *Vipāka-Sūtra* with 1,84,00,000 canonical

padas in comparison to the existing 5000*pada* size or approximately 99.97% lost. Thus, the assumption of mythological size or its loss to the extent of 99.97% will erode the canonical credibility together with the regard for spiritual power of the Ācāryas. The days of impressing by size are gone. Hence one must accept the canon size as it is current, assuming some reasonable memory loss.

Table 6 : Extrapolative character of the Jainas.

Point	Hindus	Jainas
1. Cosmography	4-7continents	Innumerable continents
2. Wives of Cakravartī	16,000	96,000
3. Age of Universe cycle	10^{15} yrs.	10^{77} yrs.
4. Incarnations/ Tīrthaṅkaras	10/24	3 x 24
5. Deitification of Idols	Simple Pūjā	By grand elephant charioteering festival
6. Age of Kṛṣṇa	100 yrs	1000 yrs
7. Unit of time	10^{-4} Sec.	10^{-250} Sec.
8. Jambu Tree, diameter & ht.	—	90 Km.
9. Palace dimensions	—	410 x 547 x 273 meters
10. *Pada* of Letters	1/4 *ślokas*	1634, 8307, 888 letters
11. Arts for men	64	72
12. Concept of god	God is one	Every body could be god
13. Sacred canons	4 Vedas	12 *Aṅgas*

However, it must be noted that the sizes mentioned even in terms of current *padas* suggest that the primary texts are voluminous. And their commentary literature is many times more voluminous and in many forms composed during different periods after 453 A. D. when *Aṅgas* were put to writing.

Table 4 indicates that the *Pūrvas* were more voluminous than the *Aṅgas*. Secondly, as part of *Dṛṣṭivāda*, it seems that its biographical and didactic story content of *Anuyoga* section was very small with only 5000 *padas* in comparison to the 6-11 *aṅgas* having lacs of *padas* in each. This may also be one of the reasons of loss of *Dṛṣṭivāda* by memory as didactics make more permanent impressions.

It may here be mentioned that no commentator has tried to explain the difference in *padas* in books of different versions and the current position. Had they dealt with this problem, they would have served the system and its followers better. Doshi[37] has also mentioned this point.

(b) Subject Content — The subject content also reflects magnitude of a book. This is given in Table 7. One finds that the Śvetāmbara version for 11-*aṅga* is more detailed and illustrative while the Digambara version for *Dṛṣṭivāda* is not so. It seems that the extent Digambara pro-canons are mostly based on *Pūrvas* rather than *Aṅgas*. However, it could be verified that the variety of contents in the *Aṅgas* is enormous, covering every sphere of physical, spiritual and moral universe. Despite this, some differences in the content mentioned in the two versions may be pointed out. These differences suggest that these holy books were not thoroughly studied to tell the actual contents. The contents were pointed out according to interests.

Table 7 : Contents of Primary *Aṅgas*.

Aṅga	S-version	D (JD) Version
1	2	3
1. *Ācārāṅga*	Rules, practices of mendicancy (food, dress, residence, etc.). Five types of practices – faith, knowledge, conduct, penance and internal energy.	*Rules, practices* for ascetics.

1	2	3
	Description about living/ non-living, non-violence, etc.	
2. *Sūtra-kṛtāṅga*	Description of doctrines of self and others. Descriptions about Universe, living, other realities.	Different doctrines, Feminology, Masculinity, sexology, etc.
3. *Sthānāṅga*	Cataloguing different catogories in the universe under 1-10.	Cataloguing with respect to substance, time, etc.
4. *Sama-vāyāṅga*	Cataloguing of different categories of subjects with successive numerical increments. Details about contents of *Aṅgas/Pūrvas*. Descriptions about 54/63 great men.	Collective description of material with respect to place, substance, time etc.
5. *Vyākhyā-prajñapti*	36,000 questions and answers regarding universe and its tri-timic phenomena. Description about various doctrines of Mahāvīran age.	60,000 questions & answers. Description about good/ bad from many viewpoints.
6. *Jñātā-dharma-kathā*	350 lac legendary stories of those attaining salvation under different karmic dispensations. Description about culture, civilisation, geography of different periods.	legendary religious stories by lords through divine speech.

1	2	3
7. *Upāsaka-daśāṅga*	Legendary stories about Jina devotees, how they prospered and liberated. Eleven *pāramitās* (model stages) of laity and other religious performance. Other contents as in (6).	11 model stages of laymen's spiritual progress.
8. *Antakṛd-daśāṅga*	Legendary stories about liberated men and women with moral didaction.	Legendary stories about ascetics liberated through acute painful life during *Tīrthaṅkara*'s periods.
	Various aspects of religion.	
9. *Anuttaro-papātika Daśā*	Stories about ascetics transcendented to higher *vimānas* through acute sufferings and austerities.	As in column 2.
10. *Praśna Vyākaraṇa**	Futurology and prognostics. Different types of accomplishments and miracles.	Prognostics, Four types of stories.
11. *Vipāka-sūtra*	Stories relating to consequences of fruition of meritorious and demeritorious *karmas*.	Same as in column 2.
12. *Dṛṣṭivāda***	*Parikarmas* 7 types.	*Parikarmas* 5 types.
	Science of sacred incantations or Mathematics.	Solar/lunar astronomy. Oceanic/continental geography. Living, non-living & the liberated.

1	2	3
	Sutra : 88 varieties.	*Sutra* : no varieties, 363 dogmas & Maths.
	Prathamānuyoga : 2 varieties legend & biography of (i) *Tīrthaṅkaras* and (ii) other torch bearers.	Legends & stories. No varieties.
	Pūrvagata : 14 varieties, no contental description.	*Purvas* : 14 varieties. See table 4 for contents.
	Cūlikā : No varieties No details available.	*Cūlikā* : 5 varieties. Science of incantations, rituals, austerities regarding specific movements in earth, sky, etc.

* Current book contains stories about 5 sins, 5 merits and details of many tenets, expained therein.

** *Sthānāṅga* (4.131, p. 325) does not mention *Cūlikā* as a variety of *Dṛṣṭivāda*. It points only four varieties.

Table 7 gives us a reflection that there is a large difference in the contents of (a) *Vyākhyāprajñapti* and (b) *Upāsakadaśā*. Secondly, it is also not clear why there is difference in the number and name of the varieties of *Parikarma* in the two sects. Other such differences can also be observed. Thirdly, the name of *Vyā- khyāprajñapti* is duplicated in Digambara version under *pari-karma* group which needs investigation. Fourthly, the contental details of *Praśnavyākaraṇa* are not found in current versions. Why the original could not be assumed to be lost though at a much later date than *Dṛṣṭivāda* ? However, one may guess that astrology and prognostics were in an impressive vogue in olden days.

The contental disparity of *Dṛṣṭivāda* in both the sects suggests that while Digambaras did not give much importance to the 11-*Aṅgas*, the Śvetāmbaras were averse to the twelfth *Aṅga*. These and many other discrepancies require deeper elaboration. Though the Digambaras may not bother about them, as, for them, the canons are said to be lost and per chance what they have said about the magnitude should be assumed as just heresays and not authentic. However, as they are suppo-sed-to-be-authentic and canon-like books of Akalaṅka and Vīrasena describe the details, the differences or contradictions require intensive examination.

There is large number of difference in the magnitude of size and contents of canons in the two major sections of Mahāvīra's followers. How they may be called them as authe-ntic? The criteria for the authenticity have been the following :

(i) Composition by *Tīrthaṅkaras,* their chief as well as remote disciples (the disciple lineage could not be extended too far as there is a gradual loss of retentive power and attendant internally concentrated energy).

(ii) The absence of contradictory testimony-intellectual or otherwise for the canonical contents. This has been called the consistency of the descriptions.

However, we say that canons are not physically compo-sed by the *Tīrthaṅkaras*. Their chief disciples listened the divine speeches, memorised and put the contents in technically abbre-viated forms. A large amount of omissions and commissions in their contents and meanings due to gradual reduction of destruction-cum-subsidential knowledge-obscuring *karma* of later scholarly disciples who put them in their own way, is assumed. Shastri[37] and Jaina[38] have illustrated a large number of inter and intrá-canonical contradictions and incompatibilities with current scientific facts. All these points suggest that a non-traditional evaluative method of their studies be evolved. The same contention is applicable to the secondary canons, though their contental details are not available canonically, still quite a

number of them represent the first few books of the Jaina ascetic duties and practices.

Jaina system is a polyrealistic one with a high spiritualistic bias. Consequently, its basic texts must deal with the phenomena of physical universe alongwith the spiritual kingdom. The traditional ascetics and scholars communicated mostly their spiritual contents and kept mum about their physical contents. The Table 5 a, b, suggests that most of the texts have about a fourth or more part dealing with this category of contents, either in separate chapters or stray or casual mention in different chapters. Some texts are fully devoted with this category. It was the practice of early scholars to sermonise analogically with the help of illustrations from the laymen's life. Hence a large amount of physical and observational contents could become part of these texts. It could be illustrated from *Daśavaikālika* containing more than one-third of its total contents dealing with the physical aspects :

(i) *Ṣaḍ-jīvanikāya* — Six types of living beings (Physics, Chemistry, Biology).

(ii) *Piṇḍaiṣaṇā* — Science of food and its purity for mendicants.

(iii) *Vākyaśuddhi* — Science of speech.

Besides, there are analogical mentions of physical phenomena. Similar is the case with other texts. Physical or scientific contents of these texts could be collected, analysed and classified into the following branches of current sciences :

1. Physics — General properties of matter, Heat, Light, Sound, Electricity, Magnetism, Atomic energy, etc.

2. Chemistry — Atoms, aggregations, mixtures, molecules, compounds, properties and structures, Chemistry of living/non-living, Classifications, etc.

3. Botany — Science of plant kingdom–non-mobile beings.

4. Zoology — Science of insects, animals and humans, mobile living beings.

5. Food & Nutrition — Dietetics and food science.
6. Medicine — Science of *Prāṇavāya*, Āyurveda.
7. Mathematics — Worldly and super-worldly.
8. Cosmology — Geography.
9. Astronomy & Astrology.
10. Engineering Science.
11. Humanities and Performing Arts — Education and useful arts for men and women.

A good number of stray efforts have been made by many scholars of this age in analytical reporting of these contents. However, a concerted and evaluative effort is needed for an overall picture regarding these contents and their comparative contribution in the contemporary knowledge of different period of their compositions. This evaluation will lead us to judge the growth in knowledge in different areas at present with reference to canonical age. This study of scientific contents is actually desired to re-establish faith in canonical sermons in these days of traditional faith erosion on intellectual grounds.

Digambara Prākṛta Pro-canonical Literature

It is agreed that Bhadrabāhu-1[39] was the last all scripture-knowing scholar (preceptor-period, 29 yrs., contemporary of Sthūlibhadra) before the two sects of Jainas began making their pseudo-appearance culminating as distinct schisms in late first century A. D. known as Digambaras and Śvetāmbaras. The Digambara tradition of preceptors continued upto 683 years after Mahāvīra (683 – 527 = 156 A. D.)* with aphorismic wise sayings through Gautama – the first chief disciple, as the base (in contrast to Sudharmā, the second chief disciple as the base in Śvetāmbara tradition). Shastri opined that the first stage of this tradition could be assumed to continue upto 5th century A. D. (i. e. 350 B. C. – 500 A. D.) by which the proximate and remote preceptors were communicating the *Śruta* orally in their own words. They also agreed about the oldest existence and

* Currently, the salvation of Mahāvīra is being dated at 468 B. C. thus, it is 683 – 468 = 215 A. D.

importance of the two types of *Śruta* with its size and contental description. They hold however, that almost all the *Śruta* has been lost because of absence of knowers gradually by 156 A. D. (215 A. D.). Thus, the Digambaras do not treat the extant canons as authentic because of large number of interpolations in them during the three councils between 357 B. C. to 453 A. D., i. e., nine hundred and eighty years after Mahāvīra, whereby they lost their original form. They neither took part in these congregations nor thought of committing the original version to writing even at a later stage, per chance feeling this act as going against the rules of naked asceticism. They could not realise the importance and future implication of this conservatism realised by present scholars. Two surprisingly contradictory phenomena are observed in this case which require clarification :

(i) The Digambaras have proved themselves more conservative in following their ascetic discipline restricting it for the self only.

(ii) The better ascetic discipline of meditation, equanimity etc. should be associated with more internal energy and capacity to memorise. Despite this, Malvania has proved with the help of 683 year tradition that the rate of loss of scriptures in Digambaras, is comparatively very high.[40]

However, all the scriptures are not lost at a time, they are lost partly and there might still be partly scripture-knowing preceptors. They mentioned about the existing scriptures upto the beginning of ninth century A. D. (i.e. *Dhavalā* period) but nothing about their written form. The reason for not committing the original scriptures to writing and higher rate of their loss in case of Digambaras requires critical evaluation.

The Digambaras, thus, have no original canon extant. Whatever they have at present, is some pro-canonical texts composed between 100 B. C. to 500 A. D. However, whether the extant canonical literature is religiously recognised by them or not, their contents are important for scholarly studies, because a good part of this literature, though put to writing at a later

stage and also existent partially as Digambaras contend, has a high antiquity with respect to tradition and contents in comparison to the existing Digambara pro-canons. It is not clear whether they form a separate category with respect to primary and secondary canons.

This is further astonishing that the Digambaras disregard the total loss of *Aṅgas.* However, as Bhadrabāhu-I did not give substantial recitation of entire twelfth *Aṅga,* i.e. *Dṛṣṭivāda,* the Digambaras presumed that it existed partially and it is more important than the *Aṅgas* as it contained the archaic Pārśvan *Purvas.* Quite a good amount of *Purva* part has been in memory of many Digambara scholars upto 156 A. D. (215 A. D.) who could commit the memorised material to writing in the form of books. The texts composed upto the second century A. D. or so by these communicative scholars are treated with canon-like authenticity and regard. The first two of these texts are given in Table 8 followed by some other similar but later texts. The composition period given is approximate and seems comparatively more justifiable. The Kundakunda period should be considered on the basis of its comparative contents and it should neither be stretched too far nor contracted too early out of love for unconfirmed logic and antiquity based devotion. He should be taken as post-Yāpanīya *ācārya.* The above facts suggest that Dixit[41] is not justified in questioning the salvaging of *Purva* material in these texts on his fabricated basis. However, he may be right in his suggestion that contentally these texts were devised in such a way as to make the canonical studies superfluous and, therefore, contrary to the Śvetāmbaras attitude of preservation of older texts unnecessary. That is why, despite their mention by later scholars like Pūjyapāda, Akalaṅka and others, no reference is found due to their early repudiation, though Yāpanīyas did refer them.

It is seen from Table 8 that Digambara pro-canons are not only small in number but in size too. For example, *Mūlācāra* – a counterpart of *Ācārāṅga* has half its size. But size is secondary

Table 8 : Details of main Digambara Pro-canons.

Name	Author	Period (App.)	Sections	Ślokas	Contents
1. *Kaṣāya Prābhṛta*	Guṇadhara	35-100 B. C.	15	233	Passions, subsidence & destruction of deluding *karma.*
2. *Ṣaṭ-khaṇḍāgama*	Puṣpadanta, Bhūtabali	75-150 A. D.	6	7000 (aphorisms)	*Karma* theory, Disquisitional treatment, Sciences.
3. *Bhagavatī Ārādhanā*	Śivārya	100-150 A. D.	1	2148-70	5 types of ascetic disciplines, deaths, meditation
4. *Mūlācāra*	Baṭṭakera	100-200 A. D.	12	1252/1403	Ascetic discipline, basic Jaina tenets.
5. *Prābhṛta-traya*	Kundakunda*	150-250 A. D.	16	885	Ideal/real living, knowledge & knowables, ascetic discipline, six realities, five existences, etc.

* According to new researches, the period of Kundakunda is being fixed as 6th century A. D. (See Aspects of Jainology, Volume III, P. V. Research Institute, Varanasi, 1991, pp. 187-206).

in comparison to contents. Despite large amount of similarity in contents like purity of foods and practical conduct, *Mūlācāra* seems to be quite advanced in systematisation, classification and descriptions suggesting its late composition. There are also many topics which are either non-existing or elementarily mentioned in primary canons. Moreover, Digambara early texts do not contain legendary, didactic biographies and religious stories (though mention of some story characters are made in *Bhagavatī Ārādhanā*). However, other contents in these pro-canons are as varied as the other canons. Despite the dominance of the theme of five-fold practices for spiritual development, there is a good amount of material relating to physical world which could be classified in the forementioned categories with similar approximate proportion of contents as given below :

(i) *Ṣaṭkhaṇḍāgama* — Nearly 2 section out of 5.

(ii) *Mūlācāra* — 3 sections out of 12.

(iii) *Bhagavatī Ārādhanā* — app. 400 *gāthās* out of 2170.

(iv) *Prābhṛta-traya* — app. 300 *gāthās* out of 885.

However, the Digambara pro-canons have scientific contents mainly relating to three fields : (i) Physics, (ii) Chemistry, (iii) Biology. Other sciences find occasional and analogical mention.

The stretching of Digambara pro-canonical literature upto that composed till about tenth century or later, containing even books on logical subjects and biographies, does not appeal to reason because of their complexity and intellectualism.

Linguistic Compositions of Digambara Pro-canon

The Digambara canon-like texts are mostly written in Śauarsenī Prākṛta and were composed by authors mostly of south and north (Mathurā) during 35 B. C. to 250 A. D. It might be possible that the older oral traditions were prevalent there, but textual compositions were none.

In contrast, the Śvetāmbara tradition, permitting composition of books in Āryarakṣita days, got its canon in writing in

app. 460 A. D. The textual language has a form known as Jaina Mahārāṣṭrī. This has some specialities in comparison to the Jaina Śaurasenī which the linguists can very well identify. It is established that this western language was originated much later. They make it a point to prove Śvetāmbara canons as a later compostion. Most western scholars, however, have linguistically verified and confirmed that a good number of these canons (if not canons, their contents) are of early origin, though it is agreed that the second part of them are later additions. We are more concerned with the conceptual contents whose gradual developments will enable us to guess about the early or late historicity of these texts.

With the foregoing discussion, one could now guess that linguistically *Purvas,* Digambara pro-canons and Śvetāmbara canons cover a period of about 600 B. C. to 500 A. D., i.e. the first and second stage of Prākṛta development. Though a good amount of explainatory, commentary (and some original) literature in Prākṛta was written later, but it is not included in this study as it could not come under canonical class.

Period of Composition of Canons and Pro-canons

The current analytically evaluative age has developed certain procedural concepts regarding objective studies in any branch of learning. This enables the researcher to assess the developmental position of the branch from its nucleation period to the period of study. It is done by studying the available literature in such a way which might give a reasonable mental construct chronologically so as to measure the conceptual or otherwise growth, the branch has undergone in different periods of time or the progress it has made since its nucleation point. This also enables one to frame a future picture about it. The western philosophy and science has grown to an alarming extent, realised by all, following this well developed and intellectually logical procedure.

This progress by westerners in a relatively shorter period has forced the orientalists to ponder over the cause their glorious

past failed to keep pace with the present. The Jaina school will specially be discussed here in this context.

The western evaluative practice is generally not appreciated in the Orient though the oldest literature like *Ācārāṅga* and *Samayasāra* tell us that doubt, examination and conscientious thinking are the methods for proper knowledge and growth. *Viveka-cūḍāmaṇī* states that canonical attachment is an obstruction of knowledge like the attachment to body and worldly affairs. It is on this basis that our canons have become so important and they will remain so in the scholar's view for the times to come. They indicate the scientific approach for obtaining growth of knowledge. But, apparantly, this approach was rare in early days and completely lost in middle ages due to the following facts :

(i) The concept of all-knowing and omniscient was nurtured in parallel with the divine origin of the scriptures of the Vedic system. This was a large improvement over the divinity concept.

(ii) The concept (a) involved the idea that all-present, past and future is known by and through the divinity or omniscient. There is nothing left to be known. The process of knowledge became static one like a pond rather than an everflowing river.

(iii) The concept (a) also led to the idea of the infinite authenticity of past and non-credibility of the current scholarship. Thus, stagnancy in conceptual and realistic growth appeared.

(iv) Due to super-authenticity vested in the all-knowers, every subsequent scholar, *ācārya* based his credibility on them, and often kept mum even about his identity and the period in his works. He merged his identity in the Attained and the early scholars did not even mention their names. It is from counter-references that many authorships are ascertained. This tendency may be a quality of submission out of devotional tradition. However, this trend of early Jaina *ācāryas* is not to the liking of modern scholars.

(v) This trend has highly confused about the authorship of most important early texts of Digambaras specially. One still finds many disputes today about their authorship and historicity. The modern scholars wish to clarify certain points as to evaluate the conceptual growth comparatively.

Dixit[42] rightly says that thought process is like a living system, assimilating new material and discarding the waste for its proper growth. Modern scholars agree with him that the idea of permanent constancy of thought is a mis-conceived one. One cannot substantiate it by deeper studies of Jaina texts themselves. A scientific scholar will, therefore, formulate some thesis on which to work for constructing the history of Jaina thoughts and scientific subject matter, on the basis of scriptural and documentary material available with us spread over between pre-Christian centuries and many post-Christian centuries.

This thesis requires classification of canonical literature on the basis of their approximate period of composition for their evaluative studies. Certain guidelines could be observed in this connection :

(i) Linguistic and metrical analysis,
(ii) Status of systematisation of contents,
(iii) Arrangement of contents,
(iv) Methodological tendencies.

Despite the fact that *Ācārāṅga* has the oldest linguistic and metrical pattern, the other canons do not show much linguistic peculiarities. Hence, they are classifiable on this basis. The other idea of antiquity could be based on the fact that older the text, lesser should be its systematic treatment and arrangement of subject matter. The methodology of treatment of subject matter could also form a guide in this matter.

Following the above guidelines, Dixit[43] has classified the existing canonical literature in three periodic groups as below :

(i) First period	500–200 B. C.	*Ācārāṅga, Bhagavatī* (early part) etc.

(ii) Second period	200 B. C.–100 A. D.	*Prajñāpanā, Jīvābhigama, Rājapraśnīya,* etc.
(iii) Third period	100 A. D.–500 A. D.	Digambara pro-canons, *Nandī, Anuyoga, Tattvārtha-Sūtra* etc.

This is quite approximate and could serve our purpose here. However, many authors have discussed this issue in detail for individual texts with sufficiently reasonable approximations. The personal discussion of this author with many scholars has led Table 2 for the canonical composition period. There are also some personal approximations for getting things in better direction. Table 2 confirms the opinions of many scholars that many of the canonical texts may be multi-author compositions during a certain period range. For many canons, the contents and linguistics suggest their differrent portions belonging to different periods. Some known examples could be cited :

(i) *Ācārāṅga* Part I is earlier, Part II is later.
(ii) *Bhagavatī, śatakas* 1-20 are earlier, 21-41 are later.
(iii) *Uttarādhyayana,* 4 chapters are later.
(iv) *Daśavaikālika,* chapter 4 is later.

Many texts are collections for which no author is mentioned.

It is now generally agreed that rare additions might have been made in canons after the final congregation of 460 A. D.

The table of compositional period confirms Dixit's contention and could reasonably be a guide for comparative and critical studies with historical perspective.

Procedure for Current Study

In the present study carried out with historical perspective, the various scientific contents will be grouped under several current branches to show the development having taken place in different canonical periods. The observations will be charted or tabled as and when necessary. These contents, in the end, will be compared with current stage of our knowledge to learn

the progress man has made.

Prior to that, various arts and sciences, mentioned in different canons under different science subjects will be classified. Despite the absence of much details about these branches of learnings, it could be surmised that these must be in some preliminary or developed form useful for man and women of those periods. It may be noted that there is a good amount of later literature in many canonical branches of learning.

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Chapter 3

Branches of Learning in Canons

As defined, *Śruta* is a form of knowledge obtained through verbal or written records. It also means the general learning aiming at all round development of personality and character, preservation of culture, shoulder the responsibilities of the household and society and performance of religious duties towards spiritual aspirations. These aims are achieved by learning such subjects as could strike the balance between the worldly and spiritual life and happiness. The earlier canons mention different subjects of learning as current in Mahāvīran days. It seems that the following subjects were predominantly learnt as mentioned in *Bhagavatī*[1]. They are all non-Jaina subjects which mostly involve four broad topics of today as shown in Table 1.

Table 1 : Pre-Mahāvīran subjects in *Bhagavatī*.

1. Vedic Studies

(a) Six Vedas

1.-4.Vedas,
5. History & Legends
6. Glossary or Index

(b) Six Vedic Supplements (*Vedāṅgas*)

7. Vedic phonetics (*Śikṣā*)
8. Religious Rituals (*Kalpa*)
9. Vedic Grammar (*Vyākaraṇa*)
10. Meterology (*Chanda*)
11. Etymology or Linguistics (*Nirukta*)
12. Astronomy (*Jyotiśa*)

(c) Six Vedāṅga Supplements (*Upāṅgas*)

13. Mathematics (*Ganita*)

14. Sāṅkhya Philosophy (*Ṣaṣṭitantra*)
15. Logic (*Nyāya* Philosophy)
16. *Brahman* Philosophy
17. *Parivrājaka* Philosophy (Ethics)
18. Religious Scriptures.

Pārśvan canons are not mentioned here. Per chance, they might not be very prominent at that time. It is very clear that these subjects have very limited applications for earning common man's livelihood. This point must have occurred in the mind of later scholars as to what type of useful learnings should be made available to common man for his worldly life. Religion or basic *Āgamas* teach the world as sorrowful and sinful, hence it was in the fitness of things not to mention or teach gainful learnings in early canons. However, stray references to many such learnings for princes and others have been made in *Bhagavatī* without mention of their seperate category, showing that early sections of this canon represent the period of unclassified descriptions. The *Sūtrakṛta*[2] also mentions many types of *Śruta* for livelihood.

However, it was thought essential to categorise these different learnings for the benefit of not only the common man but also for maintaining scripturists. Two categories of learnings were then presumed.

There is no mention of first category of learning supposed to be as sacred (or white ?), but it could be inferred from the name of the second category called as non-sacred, sinful or black learnings (as it teaches about worldly useful and therefore demeriting learnings[3]). Accordingly, *Bhagavatī*[4] seems to improve quite a lot upon the contemporary Mahāvīran learnings by mentioning many of them as given in Table 2. This shows that the number of departments have increased from four to seven and number of subjects from 18 to 34. It also shows that scriptology must have started by now. Newer subjects (21-34) and branches (5-7) were added which were more useful for men and women. This two-prong classifi-

cation may be taken as equivalent to worldly (*Apara*) and spiritual (*Para*) learnings of *Kaṭhopaniṣad*[5].

Table 2 : Branches of learning during Mahāvīran and Post-Mahāvīran Period.

(a) Mahāvīran Period 1	(b) Post-Mahāvīran Period 2
1. Vedic and Religious Studies	
1-4. Vedas	1-4. Vedas
5. Religious Rituals	5. Religious Rituals
6. Religious Scriptures	6. Religious Scriptures
7.Vedic Phonetics (Museology)	7. Vedic Phonetics (Museology)
2. Languages and Literature	
8. Languages (Vedic/ Samskṛta)	8. Languages (18 languages)
9. Literature (Legendary Stories)	9. Literature
10. Grammar and Meterology	10. Grammar and Meterology
11. Lexicology	11. Lexicology
12. Linguistics (*Nirukta*)	12. Linguistics
13. —	13. Scriptology
3. Humanities	
14. History	14. History
15. Logic (Nyāya Philosophy)	15. Logic
16. Sāṅkhya Philosophy	16. Sāṅkhya Philosophy
17. Brāhmanic (*Mīmāmsā*) Philosophy	17. Brāhmanic Philosophy
18. Parivrājaka Philosophy (Ethics)	18. Parivrājaka Philosophy
4. Pure and Applied Sciences	
19. Maths/Arithmatics	19. Maths/Arithmatics
20. Astronomy/Astrology	20. Astronomy/Astrology
21. —	21. Biology (Life Sciences)

1	2
22. —	22. Physics
23. —	23. Chemistry
24. —	24. Food Sciences
25. —	25. Medical Sciences
5. Fine Arts	
26. —	26. Drawing and Painting
27. —	27. Dance
28. —	28. Drama
29. —	29. Vocal Music
30. —	30. Instrumental Music
31. —	31. Sculpture
6. Military Science	
32. —	32. Warfare
33. —	33. Archery
7. Engineering Science	
34. —	34. Civil & Architectural Engg.

The Digambara pro-canons like *Mūlācāra*[6] and *Ṣaṭkhaṇḍāgama*[7] mention three categories in place of two— (i) Worldly, (ii) Vedic and (iii) Jaina (*Samaya*). The first two come under non-sacred category while the third under the sacred category. This has already been mentioned earlier. They will be dealt separately.

Non-sacred Learnings

For the sake of integrated contental approach, the non-sacred learnings should be taken as synonymous with non-canonical worldly real learnings of *Anuyogadvāra* and perverse learnings of *Nandī*. However, if the order of canons is taken into account, the first mention of this category is found in *Sūtrakṛtāṅga* (2. 2. 18) and *Sthānāṅga* (9.27) followed by *Samavāo* (29. 13) and *Uttarādhyayana*.

The number of non-sacred learnings is 9 in *Sthānāṅga* while it is 29 in *Samavāyāṅga* (taken as 13, see latter). The

current *Praśnavyākaraṇa, Āvaśyakaniryukti* and *Uttarādhyayana* have a mention of 29 of them but their names given by later commentators show that they are different from *Samavāyāṅga.* And this list is different from *Samavāyāṅga* not only in number but names also. *Sūtrakṛtāṅga* is still ahead with 64 types of non-sacred learnings as shown in Table 3.

Table 3 : Number of Non-sacred Learnings.

1. *Sūtrakṛtāṅga*	64
2. *Sthānāṅga*	9
3. *Samavāyāṅga*	13 (29-16)
4. *Uttarādhyayana*	13 (29-16) different from 3
5. *Āvaśyakaniryukti*	13 (29-16) Same as in 4
6. *Praśnavyākaraṇa*	13 (29-16) Same as in 4
7. *Anuyogadvāra*	20
8. *Nandī-sūtra*	25
9. Digambara pro-canons	No number mentioned.

There are approximately 12 names in *Dhavalā* with some other names.[7]

The number 29 has been reduced to 13 as eight of them have two types of commentaries which could not be taken as separate unit.

Strangely most of the early works have difference in qualitative and quantitative contents on the same subjects. The redactors should have attempted uniformity in all these texts for their authenticity. The discrepancies of this type are prone to faith erosion in the sermons of the Jinas. This point could be rectified only through the studies under historical perspective. There may be good number of reasons for this types of discrepancies, some of which may be as follows :

(i) Authors at different places and times might have composed their different texts without proper knowledge of early works.

(ii) Among contemporaries, the communication gap might have led to these differences.

(iii) *Sūtrakṛtāṅga* may have followed 64 tradition of Vedic system probably overlooked by other authors.

(iv) A large number of non-sacred learnings of *Sūtrakṛtāṅga* are included in 72 practical arts of *Samavāyāṅga* and other canons, not included in non-sacred classification there. This seems to be a duplication. These arts are also included as a separate category in *Sthānāṅga* in addition to a category of worldly learnings seemingly again to be a duplication as the latter involves these arts. They should have been included in the non-sacred learnings.

(v) The commentators of *Uttarādhyayana* and *Āvaśyakaniryukti* have attempted to make the *Samavāyāṅga* list as much equivalent to the *Sthānāṅga* as possible. It does, however, not supersede the all inclusive specialities of this classification.

(vi) Chronologically, Muni Nathamal[8] opines that *Samavāyāṅga* list seems to be the oldest. Others have followed it and modified it.

This list is also given in *Anuyogadvāra* and *Nandī* under different names. These, composed later, might represent another improvement over the early canonical texts. The comparative list and its branchwise classification is given in Table 4. These texts seem to harmonise the intercanonical discrepancies by assuming two ways of classifying non-sacred learnings. The first method is very general : (i) Vedic studies and (ii) 72 practical arts[9]. This seems to be very reasonable. The second method is specific in mentioning names of books, systems and many practical arts. The second method has been tabulated in Table 4. The 72 arts will be classified later in Table 5.

It is seen in Table 4 that the trend set in *Bhagavatī* stands changed in *Sūtrakṛtāṅga* and other canons. The Vedic and religious studies are nowhere there. However, they have been substituted by two important popular subjects : (a)

science of prognostics and (b) science of acquisition of various types of supernatural powers. These two branches of psychological learnings are based on empiricism and austere performances. Many canons have mentioned the prevalence of demonological performances, acquisitions and prognostics though the ascetics have been debarred from applying these learnings for livelihood and without emergency. The number of prognostical branches vary from 2 in *Sthānāṅga* to 16 in *Sūtrakṛtāṅga* and acquisitional branches vary from 2 in *Sthānāṅga* to 16 in *Sūtrakṛtāṅga.* It seems that *Sūtrakṛtāṅga* description to be sufficiently older following Vātsyāyana and *Nītisāra* numeration and *Samavāyāṅga* follows it partially.

Table 5 : Comparative table of Departments/Subjects during different Canonical Periods.

Period	No. of Departments	No. of Subjects
1. *Mahāvīran*	4	19
2. *Bhagavatī*	7	34
3. *Samavāyāṅga*	3	13
4. *Sūtrakṛtāṅga*	4	64
5. *Anuyogadvāra*	6	32
6. *Nandī-sūtra*	6	37

Despite the fact that later commentators have tried to narrow down the differential gap between *Sthānāṅga* and *Samavāyāṅga* in this regard, the former remains special. The commentators have modified the science of dreams into science of divination and added science of medicine to the list not found in the latter. Moreover, the later does not have archery and architecture. Secondly, the canons mentioning 29 non-sacred learnings point out three types of texts – aphorismic, commentatarian and supplementary for each branch of prognostics, thus making the total of 8 x 3 = 24 + 5 (additional) = 29 non-sacred texts in counting. As we are considering the branches of learnings, this textual numeration has been overlooked here and the number of learnings has been taken as

Table 4 : Classification of Non-sacred, Worldly real and Perverse learnings*

1 *Nandī-sūtra* 15 + 25 – 3R = 37	**2** *ADS* 32	**3** *Sūtrakṛtāṅga* 64	**4** *Sthānāṅga* 9	**5** *Samavāo* 29 – 16 = 13	**6** Comm- entaries
1.Vedic and Religious Studies					
1.-4. Vedas	x	—	—	—	—
5. Religious rituals	x	—	—	—	—
6. Religious scriptures	x	—	—	—	—
7. Vedic Museology	x	—	—	—	—
2. Linguistics and literature		1. Science of Prognostics			
8. Grammar and Meterology	x	1. Geology/Earthaquakes	1. Prognostics	1. Geology/ Earthquakes	x
9. Lexicology	x	2. Science of natural/ public Calamities	2. Science of natural/pub-lic calamity	x	x
10. Linguistics	x	3. Astrology	—	x	x
11. Legendary Stories	x	4. Science of Notes of Birds	—	x	x

1	2	3	4	5	6
12. Scriptology	—	5. Science of Limbal movements	—	x	x
13. *Rāmāyaṇa*	x	6. Palmistry	—	x	x
14. *Mahābhārata*	x	7. Science of bodily Marks	—	x	x
15. *Bhāgavata*		8. Dreamology		x	Sci. of divination
3. Humanities		9. Meteorology	2. Humanities	—	—
16. Kautilyan Economics and Politics	x	10. Science of glow of Horizons	3. Non-Jaina philosophies	9. Non-Jaina philosophies	—
17. Cārvāka Philosophy	x	11. Science of notes of animals	4. Worldly Learnings	—	—
18. Sāṅkhya Philosophy	x	12. Sci. of notes of crows	—	—	—
19. Vaiśeṣika Philosophy	x	13. Prognostics of dustfall	—	—	—
20. Buddha Philosophy	x	14. Progno. of hairfall	—	—	—
21. Pātañjala Philosophy	—	15. Progno. of bloodfall	—	—	—
22. Ājīvika Philisophy	—	16. Progno. of meatfall	—	—	—
23. Puśyadaivat Philo.	—	2. Humanities			

1	2	3	4	5	6
24. Māṭhara Philosophy	x				
25. Ṣaṣṭi-tantra (Roguery)	x				
26. Nyāya Philosophy	x				
27. Mīmāṁsā Philo.	x				
28. History	x				
—	Cupidology	—	—	10. Cupidology	—
4. Pure and Applied Science					
29. Mathematics	—		5. Medical Sciences		Medical Sciences
30. Astronomy/ Astrology	x	17.-20. Astronomy of Sun, Moon, Venus & Jupiter			
31. Toxicology (Nāgsukoma)	x	21.-30. Biological Sciences			
32. Alchemy (Kanakasaptati)	x	31.-37. Chemical Sciences			
33. Science of Prognostics (Bhimāsuroktā)	x				

1	2	3	4	5	6
34. Animal Sciences (Horses, Shatmukha)	x				
5. Fine and Practical Arts		3. Science of Supernatural Acquisition	3. Science of Supernatural Acquisition		
35. Drama etc. or 72 Arts	x	38.-63. Aquisitions and Learnings--26	6. Science of Incantations	11. Science of Incantations	
36. Textiles and Fabrics	x		7. Science of Magic/Jugglery	12. Science of Supernatural Acquisition 13. Science of subduation Powers	
6. Military Science		4. Military Science	4. Fine and practical Arts		
37. Military Service (Śakaṭabhadrika)	x	64. Archery	8. 72 Arts		Drama,
			5. Engineering		Music
			9. Civil Engg. & Architecture		Archery Architecture

* Repeatitions excluded, see main text. ! Commentaries on *Uttarādhyayana, Āvaśyaka Niryukti, Praśna Vyākaraṇa.* x means inclusion – means non-inclusion.

13 in the table. However, the number of departments vary between 6 to 9 and the subject between 9 and 64.

In contrast, the *A. D.* and *Nandī* seem to revive the *Bhagavatī* tradition of including Vedic studies in their lists. They do have only general branch of prognostics and no department of supernatural acquisitions so prominent in *Sūtrakṛtāṅga*. They have about 32-37 subjects in seven departments. A tabulation of these points suggests a very irregular pattern regarding the development of departments and subjects of learning during a period of 1000 years between 500 B. C. to 500 A. D. Of course, it is observed that newer subjects have been added to the list in many cases, single general subject like non-Jaina philosophy has been expanded in eleven specific philosophies like Vaiśeṣika etc. which were only two in Mahāvīran period. It also seems that *Bhāgavat* was not prevalent in *Anuyoga-dvāra* days. It got included in *Nandī* days. The number of pure and applied science subjects also show increase from 2 to 7 including medical and biological sciences. The number of practical arts increase to 72. It has also been pointed out that these arts should not only be learnt by textual and meaningful learning but by practice too[10]. In addition, 18 crafts are also mentioned for learning[11]. Table 6 classifies the growth of subjects under different categories which leads us to infer that whereas many subjects have gone up, there are some subjects which have been contracted to minimum.

The science of prognostics and super natural acquisitions may be cited as examples.

It may also be pointed out that there are many subjects which are repeated, such as legendary stories, Grammar, Mathematics and others. They have been adjusted in Table 5 assuming them as one. The numeration is also based on this fact.

Sthānāṅga has also a repetition of 72 arts which form part of worldly learnings. The traditional scholars may justify

their separate mention on the ground of Vedic and non-Vedic learnings. This, however, does not seem reasonable.

Table 6 : Growth of subjects in Different Categories.

Departments	Subjects	
	Minimum	Maximum
1. Vedic and Religious Studies	7	7
2. Language, literature & Humanities	7	46
3. Abstract Science	1	40
4. Life Sciences	1	11
5. Agriculture	0	4
6. Military Science	9	16
7. Engineering and Technology	0	11
8. Science of Prognostics	1	16
9. Science of Supernatural Acquisitions	2	26
10. Āyurveda	1	9
11. Home Science	0	26
12. Physical Education	0	8
	29	220

Two Categories of Non-sacred Learnings

The most concise categorisation of non-sacred learnings could be found in *Anuyogadvāra Sūtra* and *Nandī*. They mention its two classes :

(a) Vedic studies including Veda, Vedāṅgas and Upāṅgas — 16.

(b) 72 practical arts and crafts — 72.

This point may be disputed by many scholars because of the word *Athavā* (or) whether this could mean an alternative to dramatic art etc. or separate way of classification by itself. This author, however, feels it most reasonable to presume it as a separate categorisation. The Vedic and religious studies should include all the non-Jaina philosophies of even post-Vedic origin.

It could be shown that the seventy two practical arts category involves almost all canonical branches and subjects. It could be easily clasified in current terms and tabulated later. Formerly, the terms *Kalā* (arts), *Śilpa* (crafts and technology) and *Śāstra* (religion, philosophy and other subjects) were taken as virtually synonymous. Kauṭilya, Vātsyāyana, Śukrācārya, *Mahābhārata* and other sources mentioned sixty four arts while *Lalitavistara* indicates 84-86 arts including Vedic studies. However, if these are not counted, the number may be roughly 64. Not only this, 64 arts for women are separately mentioned. The first mention of arts as a separate non-sacred category in Jaina texts is in *Sthānāṅga* without numeration, though a partial repetition of worldly category is found in later literature. The *Sūtrakṛtāṅga's* 64 also include many of these arts. The list of seventy two arts is found in at least eight older Jaina texts or their commentaries which is tabulated in Table 7.

As earlier, it is observed that different canons have different listings with many in common and the total number of practical arts are approximately over 140. Secondly, there are many arts whose actual equivalent terms are just under guess. The author has attempted for reasonable equivalence in many cases under discussion here. Table 7 has the following characteristics :

(a) The *Sūtrakṛtāṅga* list has between 12-19 arts common in many other sources.

(b) Groupings of Arts : *Samavāyāṅga* seems to be specific in grouping the following arts under one category and if the different number of arts is added in each category, the total number of arts comes to about 86 — the number of arts given in *Lalitavistara*. It has also included many arts (124 - 138) which are mostly not found in other lists.

1. Military Science	7 topics (103– 109)
2. Chemistry/Medication	6 topics (90, 91, 112, 113, 114, 115)

Table 7 : Different Types of Learning Arts and Sciences in Various Canons.

	1	2	3	4	5	6	7	8	9	10
	SK	RP	SV	AKT	GDK	AUP	ANU	JDP	KV	KS
Number of Learnings	64	72	72	72	72	72	72	72	—	—
1. Terrestriology (Storms)	x	—	—	—	—	—	—	—	—	—
2. Meteorology	x	—	—	—	—	—	—	—	—	—
3. Dreamology	x	—	—	—	—	—	—	—	x	—
4. Astrology	x	—	—	—	—	—	—	—	xx	—
5. Science of Limbal Movement	x	—	—	—	—	—	—	—	—	—
6. Science of notes (birds)	x	—	—	—	—	—	—	—	—	—
7. Palmistry	x	—	—	—	—	—	—	—	—	—
8. Science of Distinctive marks in body	x	—	—	—	—	—	—	—	—	—
9. Science of Women Studies	x	x	x	x	x	x	x	x	—	—
10. Science of Men Studies	x	x	x	x	x	x	x	x	—	—
11. Sc. of Horses (Training & Management)	x	x	x	x	x	x	x	x	x	—
12. Sc. of Elephants (Trg. & Manag.)	x	x	x	x	x	x	x	x	x	—
13. Science of Cows and Oxen	x	—	x	x	x	x	x	x	—	—
14. Science of Sheep	x	—	x	—	—	—	—	—	—	—

	1	2	3	4	5	6	7	8	9	10
15. Science of Poultry	x	x	x	x	x	x	x	—	—	—
16. Science of Portridge	x	—	—	—	—	—	—	—	—	—
17. Science of Quails	x	—	—	—	—	—	—	—	—	—
18. Science of Young Quails	x	—	—	—	—	—	—	—	—	—
19. Science of Royal Wheels	x	x	x	—	—	x	—	—	—	—
20. Science of Royal Umbrella	x	x	x	x	x	x	x	x	—	—
21. Science of Royal Sceptre	x	x	x	x	x	x	x	x	—	—
22. Science of Swords	x	x	x	x	x	x	x	x	—	—
23. Gemology (Precious Stones)	x	x	x	x	x	x	x	x	—	—
24. Science of Coinage. Cowries or Special Gems	x	x	x	x	x	x	x	x	—	—
25. Science of Shieldings	x	—	x	—	—	x	—	—	—	—
26. Science of Prosperity	x	—	x	—	—	—	—	—	—	—
27. Science of Fiascos	x	—	x	—	—	—	—	—	—	—
28. Science of Natural or Acquired Conception	x	—	—	—	—	—	—	—	—	—
29. Science of Stimulation	x	—	—	—	—	—	—	—	—	—

	1	2	3	4	5	6	7	8	9	10
30. Atharva-vedic Incantation	x	—	—	—	—	—	—	—	—	—
31. Science of Jugglery/Magic	x	—	—	—	—	—	—	—	x	x
32. Science of Oblation with Fire	x	—	—	—	—	—	—	—	—	—
33. Archery	x	x	x	x	x	x	x	x	x	—
34. Science of Moon	x	—	x	—	—	—	—	—	—	—
35. Science of Sun	x	—	x	—	—	—	—	—	—	—
36. Science of Venus	x	—	—	—	—	—	—	—	—	—
37. Science of Jupiter	x	—	—	—	—	—	—	—	—	—
38. Meteorology	x	—	—	—	—	—	—	—	—	—
39. Science of Glow of Horizon	x	—	—	—	—	—	—	—	—	—
40. Science of Notes of Animals	x	—	—	—	—	—	—	—	—	—
41. Science of Notes of Special Birds	x	—	—	—	—	—	—	—	—	—
42. Prognostics of Dust-falls	x	—	—	—	—	—	—	—	—	—
43. Prognostics of Hair-falls	x	—	—	—	—	—	—	—	—	—
44. Prognostics of Meat-falls	x	—	—	—	—	—	—	—	—	—
45. Prognostics of Blood-falls	x	—	—	—	—	—	—	—	—	—
46. Science of Goblins	x	—	—	—	—	—	—	—	—	—

	1	2	3	4	5	6	7	8	9	10
47. Science of Semi-goblins	x	—	—	—	—	—	—	—	—	—
48. Science of Sleeping	x	x	—	—	—	—	—	—	—	—
49. Science of Unlocking	x	—	—	—	—	—	—	—	—	—
50. Cāṇḍālic Learning/Psychotherapy	x	—	—	—	—	—	—	—	—	—
51. Shabari (Kirātana) Language	x	—	—	—	—	—	—	—	—	—
52. Dravida (Tamila) Language	x	—	—	—	—	—	—	—	—	—
53. Kalingi (Oriya) Language	x	—	—	—	—	—	—	—	—	—
54. Gauri (A specific cardiolic) Language	x	—	—	—	—	—	—	—	—	—
55. Gandhari Language	x	—	—	—	—	—	—	—	—	—
56. Science of Descending	x	—	—	—	—	—	—	—	—	—
57. Science of Ascending	x	—	—	—	—	—	—	—	—	—
58. Science of Yawning	x	—	—	—	—	—	—	—	—	—
59. Science of Sustainance	x	—	—	—	—	—	—	—	—	—
60. Science of Embracing/Clinging	x	—	—	—	—	—	—	—	—	—
61. Science of Dispeptisation	x	—	—	—	—	—	—	—	—	—
62. Science of Surgery and Medicine	x	—	—	—	—	—	—	—	—	—
63. Demonology/De-demonology	x	—	—	—	—	—	—	—	—	—

	1	2	3	4	5	6	7	8	9	10
64. Science of Invisibility/Disappearance	x	—	—	—	—	—	—	—	—	—
65. Art of Writing	—	x	x	x	x	x	x	x	x	x
66. Mathematics	—	x	x	x	x	x	x	x	x	—
67. Dramatics	—	x	x	x	x	x	x	x	x	x
68. Vocal Music	—	x	x	x	x	x	x	x	x	x
69. Instrumental Music	—	x	x	x	x	x	x	x	—	x
70. Science of Musical Notes, Phonetics	—	x	x	x	x	x	x	x	—	—
71. Science of Percussion Instruments (Drums etc.)	—	x	x	x	x	x	x	x	—	—
72. Science of Archestra	—	x	x	x	x	x	x	x	—	—
73. Art of Gambling	—	x	x	x	x	x	x	x	x	x
74. Special type of Gambling/Art of Speech	—	x	x	x	x	x	x	x	—	—
75. Art of Playing by Dice	—	x	—	x	x	x	x	x	—	x
76. Art of Playing by Special Dice	—	x	x	x	x	x	x	x	—	—
77. Art of Quick Poetics/Art of Guarding City	—	x	x	x	x	x	x	x	x	—
78. Water Purification/Ceramics	—	x	x	x	x	x	x	x	—	—
79. Food Science/Agriculture	—	x	x	x	x	x	x	x	—	—
80. Art of Soft/Medicated Drinks	—	x	x	x	x	x	x	x	—	x

	1	2	3	4	5	6	7	8	9	10
81. Textiles and Fabrication	—	x	—	x	x	x	x	x	x	x
82. Cosmetics and Perfumery	—	x	x	x	x	x	x	x	x	—
83. Science of Bed-dressing	—	x	x	x	x	x	x	x	x	x
84. Art of Composing Ārya-metrics	—	x	x	x	x	x	x	x	—	x
85. Art of Riddlery Poetics	—	x	x	x	x	x	x	x	x	x
86. Magadhan Language Poetics	—	x	x	x	x	x	x	x	—	—
87. Art of Composing Non-Samskṛta 32 Letter Poetics	—	x	x	x	x	x	x	x	—	x
88. Art of Composing *Gītikā*-meter Poetics	—	x	—	x	x	x	x	x	—	—
89. Art of Composing *Anuṣṭup*-meter Poetics	—	x	x	x	x	x	x	x	—	—
90. Chemistry of Silver	—	x	—	x	x	x	x	x	—	—
91. Chemistry of Gold	—	x	—	x	x	x	x	x	x	—
92. Art of Goldsmithy	—	x	x	x	x	x	x	x	x	x
93. Women Cosmetisation	—	x	x	x	x	x	x	x	x	x
94. Building/Architectural Engineering	—	x	—	x	x	x	x	x	x	x
95. Town Planning	—	x	x	x	x	x	x	x	—	—
96. Construction of Army Barracks	—	x	x	x	x	x	x	x	—	x

	1	2	3	4	5	6	7	8	9	10
97. Science of Measures	—	x	—	—	—	—	—	—	—	—
98. Astrology/Medicine/Military Science : Counter movement of Army Art	—	x	x	x	x	x	x	x	x	—
99. Military Science : Arraying of Army in War	—	x	x	x	x	x	x	x	—	—
100. Cyclic Arraying of Army	—	x	—	x	x	x	x	x	—	—
101. Garudic Arraying of Army	—	x	—	x	x	x	x	x	—	—
102. Wedge Arraying	—	x	—	x	x	x	x	x	—	—
103. General Fighting	—	x	x*	x	x	x	x	x	—	x
104. Wrestling	—	x	—	x	x	x	x	x	—	—
105. Intense Fighting	—	x	—	x	x	x	x	x	—	—
106. Sight Fighting/Stick Fighting	—	x	—	x	x	—	x	x	—	—
107. Fist Fighting/Boxing/Pugilistic Fighting	—	x	—	x	x	—	x	x	—	—
108. Hand-to-Hand Fighting	—	x	—	x	x	x	x	x	—	—
109. Creeperlike Fighting	—	x	—	x	x	x	x	x	—	—
110. Art of Divnie Arrows/Transformation	—	x	x	x	x	—	x	x	—	—
111. Art of Swordery	—	x	x	x	x	—	x	x	—	—
112. Silver Digest (Pak)	—	x	x*	x	x	x	x	x	—	—

	1	2	3	4	5	6	7	8	9	10
113. Gold Digest (Pak)	—	x	—	x	x	x	x	x	—	—
114. Metal Digest	—	x	—	—	—	—	—	—	x	x
115. Jewel-Gem Digest	—	x	—	—	—	—	—	—	—	—
116. Rope Tricks	—	x	x*	x	x	x	x	x	—	x
117. CircularPlay-tricks/Playing with Fabrics	—	x	—	x	x	x	x	x	—	—
118. Special Type of Gambling (Nalika-khela)	—	x	—	x	x	x	x	x	—	—
119. Art of Piercing Leaves	—	x	x	x	x	x	x	x	x	x
120. Art of Drilling Hard Earth	—	x	—	x	x	x	x	x	—	—
121. Art of Animation/Inanimation	—	x	x	—	—	—	—	—	—	—
122. Science of Omens/Omenology	—	x	x	x	x	x	x	x	x	—
123. Science of Dramatic Dressing/Painting	—	x	x	x	x	x	x	x	—	—
124. Science of Planet Rahu	—	—	x	—	—	—	—	—	—	—
125. Planetology	—	—	x	—	—	—	—	—	—	—
126. Town Planning	—	—	x	—	—	—	—	—	—	—
127. Army Barracking	—	—	x	—	—	—	—	—	—	—
128. Horses Training	—	—	x	—	—	—	—	—	—	—
129. Elephant Training	—	—	x	—	—	—	—	—	—	—

	1	2	3	4	5	6	7	8	9	10
130. Knowledge of Special Learning	—	—	x	—	—	—	—	—	—	—
131. Science of Incarnation	—	—	x	—	—	—	—	—	—	—
132. Science of Knowing Secrets	—	—	x	—	—	—	—	—	—	—
133. Sc. of Direct Knowing About Objects	—	—	x	—	—	—	—	—	—	—
134. Planetory Motion/Science of Military Movements	—	—	x	x	x	—	x	x	—	—
135. Chemistry of Perfumes	—	—	x	—	—	x	—	—	x	x
136. Art of Flowering/Tasting of Foods/ Art of Wax-technique	—	—	x	—	—	—	—	—	—	—
137. Counter Arraying of Army	—	—	x	x	x	x	x.	x	x	—
138. Art of Home Construction	—	—	x	—	—	x	—	—	—	—
139. Powder Technology	—	—	—	x	x	x	x	x	—	—
140. Art of Inanimation	—	—	—	x	x	x	x	x	—	—
141. Agriculture	—	—	—	x	x	x	x	x	—	—
142. Science of Architecture	—	—	x	—	—	—	—	—	—	—
Total	64	72	72	72	72	72	72	72	26	24

— : means non-inclusion x : means inclusion * : All variables included in one class

3. Sports	3 sports (116, 117, 118)
4. Piercing/drilling	2 crafts (119, 120)

18 in 4 groups or 18 – 4 = 14 : [86 – 14 = 72 Arts]

(c) Some canons have grouped similar two into one :

(i) Arts of Metallurgy and Calcination (*Sajīva-nirjīva* of Metals)

(ii) *Cāra-Praticāra*

(iii) *Vyūha-Prativyūha*

(iv) *Skandhāvaramāna* and *Skandhāvaraniveśa*

(v) *Nagaramana* and *Nagaraniveśa*

(vi) *Īṣuśāstra* and *Tṣarupravāda*

Their distinctive meanings are not clear, still many canons have them separately.

(d) Non-inclusion of many arts of *Samavāyāṅga*

Table 7 indicates that *Rājapraśnīya, Jñātādharmakathā, Aupapātika, Antakṛta, Jambūdvīpaprajñapti* and *Anuttaropapātika* do not contain the following arts listed in *Samavāyāṅga* and *Sūtrakṛtāṅga* :

14, 25, 26, 27, 34, 35, 16, 17, 18, 124-138

There are some other cases too which could be easily sorted out individually.

(e) Additional listings in different texts

In contrast to (d) above, different canons have many arts which are not found in *Samavāyāṅga* and *Sūtrakṛtāṅga*. They are listed as below :

75, 81, 88, 90, 91, 94, 100, 101, 102, 114, 115, 120, 139, 140, 141.

(f) Many names of the arts are defined differently by different authors as shown below :

(i) *Purāṇa-kāvya/Pauraskṛtya*	(a) Art of quick poetics (b) Guarding or administration of city
(ii) *Īśitva/Īṣuśāstra*	(a) Art of Transformation

	(b) Art of Divine arrows
(iii) *Janavāya*	(a) Special type of gambling
	(b) Art of speech or discussion
(iv) *Udakamṛttikā*	(a) Science of Ceramics
	(b) Water treatment or purification
(v) *Praticāra*	(a) Art of movement of Army (counter)
	(b) Planetary movements
	(c) Medicine
(vi) *Cāra*	(a) Movement of Army
	(b) Movement of Planets
(vii) *Aṣṭāpada*	(a) A specific type of gambling
	(b) A special play with dices
	(c) Chess
(viii) *Asthi/muṣṭi/dṛṣṭi Yuddha*	(a) Stick fight
	(b) Fist fighting
	(c) Sight fight
(ix) *Madhusiktha*	(a) Art of flavouring and tasting
	(b) Art of Wax-technics
(x) *Varta-cheda*	(a) Art of tilling the land
	(b) Art of textile fabrics
	(c) Circular playing
(xi) *Muṣṭi* Yuddha	(a) Boxing
	(b) Fist fighting

The current age demands accurate definitions of these arts so that there could be no ambiguity in their analysis. Table 7 mentions these meanings as such in its listings.

(g) Repetition or Inclusion : Names of many arts seem to be repetitions or inclusive of each others as shown below :

(i) *Utpāta* – *Ulkāpāta* — *Ulkāpāta* is included in general *Utpāta*.

(ii) *Grahacarita* — It includes Sun, Moon, Jupiter, Venus and Rahu systems.

(iii) *Śakuniruta* — It includes science of sounds of animals and birds.

(iv) *Gandhayukti/Cūrṇayukti* — *Samavāyāṅga* translator gives the similar meaning to both the terms.

(v) *Nagaraniveśa/Nagaramana* — These have similar meanings of town planning.

(vi) *Lavaka and Vartaka* — These are birds with similar lexical meaning.

It is hoped that the Āgamic specialists will try to clarify the above points so that better understanding may be possible for the younger generation.

Current Classification of Arts or Learning Skills

Gupta[5] seems to be the first scholar who attempted to classify ancient Indian arts under current branches of learnings. Though his groupings do not seem to be quite modern, still, a clue can be taken from his work. One could classify the current learnings under two broad terms – (a) Faculties and (b) Subjects under each faculty. Accordingly, the different arts will be classified under the following faculties – 12 in number :

1. Vedic Studies and Religion	16 Vedic subjects
2. Abstract Sciences	Physics, Chemistry, Maths, Military Science, Astronomy/Astrology
3. Humanities	Language and Literature, Philosophy, History, Economics, Politics etc.
4. Biological Sciences	Botany, Zoology
5. Āyurveda/Medicines	8-member branch of Indigenous medicine.
6. Agriculture	Crops, Gardening.
7. Technology	Ceramics, Pharmacy, Useful materials.
8. Home Science	Cookery, Cosmetics, Dressing, Household arts.

9.	Engineering/Architec.	Civil Engineering, Architecture.
10.	Sports and games	Chess, gambling, dice, etc.
11.	Prognostics	Different branches of prognostics.
12.	Supernatural or surprising arts	Many magical or surprising arts

We see that we do not find three current faculties : Library and Information Sciences, Commerce and Law and Modern Medicine. Of course we should have nothing about what we call allopathic medicines; but we have the *Āyurveda* for it. The newer listings in *Kalpasūtravṛtti* and *Kuvalayamālā* do have it. The information science is definitely a subject of very recent origin which was non-existent in early days. Though trade and commerce is one of the arts for women but it is not known why it does not occur in general arts. Later listings have included it.

It may, however, be noted that the contental status of most of the canonical subjects seems to be quite introductory in many cases. It could be taken as an early stage of the development with reference to the current status of contents.

The faculty-wise classification of arts is given below :

1. Faculty of Vedic studies and Religion

1-7. Subjects mentioned in Table 2.
8. Science of oblation with fire.

2. Faculty of Humanities

(a) Language, Linguistics and Literature.

1-8. Subjects described earlier in Table 2.
9. Science of speech and discussion.
10. *Arya* meter poetics.
11. Art of Riddlery.
12. Magadhan Language.
13. Gītikā meter poetics.
14. Prākṛta language and literature.
15. 32-lettered *śloka* poetics.
16. *Sābarī* language.

17. *Drāviḍī* language.
18-19. *Kaliṅgī* and *Gauri* Language.
20. *Gandhārī* poetics and language.
21. Science of quick poetics.
22. Science of Incantational studies.

(b) Kautilyan economics and politics.

(c) History.

(d) 1-11 Philosophy (Table 4)

(e) Polity.

12-14 Science of Royal wheel, sceptre and umbrella.

(f) Music and Performing Arts.

1. Dramatics and dancing.
2. Vocal music.
3. Instrumental music.
4. Science of phonetics.
5. Science of percussion instruments.
6. Science of Archestra.
7. Painting.

3. Faculty of Abstract Sciences

(a) Physics : Astrology and Astronomy.

1. Planetary Kingdom.
2-6. Solar, Lunar, Venus, Jupiter, Rahu physics.
7-8. Planetary motions and counter-motions.
9. Astrology.
10. Gemology.
11. Gemology of *Kākinī* gem.
12. Weights and measures.

(b) Chemistry

1. Chemistry of water and its purification/treatment.
2-3. Chemistry of Silver and its medication.

4-5. Chemistry of Gold and its medication.
6-7. Chemistry of Perfumery and art of making perfume powders.
8. Chemistry of flavouring and tasting foods.
9. Chemistry of cosmetics.
10. Science of sleeping medication.
11-12. Metallurgy and calcination.

(c) Military Science

1-2. Arraying and counter-arraying of Army.
3-4. Cyclic and Gāruḍic arraying of Army.
5. Wedge arraying.
6. Normal war.
7. Special war.
8-10. Intense, stick and fist fighting.
11-12. Hand to hand and cover fighting.
13. Archery.
14. Swordery.
15-16. Horse and elephant riding.

(d) Mathematics

4. Faculty of Biological Sciences

(a) Zoology

1-2. Science of men and women studies.
3-4. Science of horse and elephant studies.
5-6. Science of cow and cock studies.
7-8. Science of sheep and partridge studies.
9-10. Science of quails and young quails studies.

(b) Botany

5. Faculty of Āyurveda

1. Science of dyspeptisation.
2. Science of surgery and medicine.
3. Science of natural and artificial conception.

4-6. Science of gold, silver and metal digest medication.
7. Science of gemal medication.
8. Science of stimulation.
9. Psychotherapy.

6. Faculty of Home Science

1. Home management.
2. Women cosmetics and makeup.
3. Food science.
4. Science of soft and medicated drinks.
5. Science of bed-dressing.

7. Faculty of Technology

1-2. Goldsmithy and ceramics.
3-4. Textiles and leather science.

8. Faculty of Engineering

1-2. Art and Science of Architecture and Building construction.
3-4. Art and Science of Town planning and construction.
5-6. Art and Science of Buildings/Army barracks/ residences.
7. Art of drilling rock.
8. House building on mountains.

9. Faculty of Sports and Games : Physical Education

1-2. General and special gambling.
3-4. Playing with general and special dices.
5-6. Rope trick and circular playtrick.
7. Art of piercing leaves/papers.

10. Faculty of Prognostics

1-2. Science of terrestriology and public natural calamity.
3-4. Science of Dreams and Palmistry.
5-6. Science of limbal movements and sounds of birds.

7.-8. Astrology and science of distinctive marks on body.
9. Meteorology.
10. Science of horizontal glow.
11.-12. Science of notes of animals and birds (wild).
13.-16. Prognostics of dust, hair, blood and meat-falls
17. Science of Omens

11. Faculty of Supernatural and Surprising Arts

1. Science of divine arrows, arms and weapons.
2. Science of Incantations.
3.-4. Science of secret knowing and special learnings.
5.-6. Science of direct knowing and magic.
7.-8. Science of prosperitisation and fiascos.
9.-10. Science of throwing upwards and downwards.
11.-12. Science of yawning and sustainance.
13.-14. Science of de-demonisation and disappearance.
15.-16. Science of goblins and semi-goblins.
17.-18. Science of unlocking and demonology.
19. Science of yogic embracing postures.

This classification leads one to compare the number of subjects taught today and in the canonical days. He can also judge about the variety, quality and quantitative character of the new learnings of the day.

Practical Arts for Women

Women form an important part of society as a whole. How their case could become a left over one ? Though the first few and older Prākṛta canons do not mention learning arts for women separately, but *Jñātādharmakathā*[12] and *Praśna-*

vyākaraṇa mention 64 arts for women without naming them, per chance, this mention may be a later inclusion which could be an influence of *Mahābhārata* and Vatsyāyana. *Jambūdvīpa-prajñapti Vṛtti, Prameyaratna-mañjūṣā* and *Śivatattva-ratnākara* mention 64 arts and crafts for women[13]. Table 8 gives these names in the two references alongwith Vātsyāyana. It is observed that there is a large difference in the three references with a similarity of about 25-30 % in each list. It is also found, by comparison, they about one-fourth of the womens arts and crafts are the same as in the general 72 arts detailed above. The total of the list comes to be about 140 including all common ones.

Table 8 : Sixty-four Arts for Women.

1	2 VN	3 JPV	4 STR	5 General
Number of Arts/Learnings	64	64	64	47
1. Vocal music	x	—	x	x
2. Instrumental music	x	x	x	x
3. Dance	x	x	—	x
4. Painting	x	x	—	x
5. Drum playing	x	x	—	x
6. Art of Characterising	x	—	—	—
7. Engraving	x	—	—	—
8. Embriodery	x	—	—	—
9. Weaving/Tailoring/Knitting	x	—	x	x
10. Souping	x	—	x	—
11. Cookery	x	xx	—	—
12. Beautification	x	—	—	x
13. Ornamentation	x	x	—	x
14. Head dressing	x	—	x	—
15. Flower beds	x	—	—	—
16. Surface-dressing	x	—	—	—
17. Cosmetics art	x	—	—	x
18. Bed-dressing	x	—	—	x

1	2	3	4	5
19. Physical sporting	x	—	—	x
20. Flower-dressing	x	x	—	—
21. Water sports	x	—	—	—
22. Flower cresting	x	—	—	—
23. Dress-wearing	x	—	—	—
24. Dress-making	x	—	—	—
25. Ear-dressing	x	—	—	—
26. Art of perfumery	x	x	x	x
27. Art of incantations, rituals and mystical diagrams	x	x	x	x
28. Bamboo crafts	x	—	x	—
29. Science of omens	x	x	x	x
30. Science of justice	x	—	—	—
31. Politics	x	—	—	x
32. Jugglery	x	—	x	x
33. Magic	x	—	—	—
34. Riddlery	x	x	—	x
35. Last Lettery	x	x	—	—
36. Secret wordings	x	—	—	—
37. Secret writings	x	—	—	—
38. Art of reading	x	—	—	x
39. Dramatics	x	—	x	—
40. Problematic compositions/Art of cavilation	x	—	x	—
41. Civil Engineering	x	x	—	x
42. Gemology	x	x	x	x
43. Metal dressing	x	x	x	x
44. Enamelling	x	—	—	—
45. Gardening	x	x	xx	x
46. Cock, Sheep, Portridge Fighting	x	—	x	—
47. Parrot-messengering	x	—	—	—
48. Annointing & massaging	x	—	—	—
49. Finger tipping	x	—	—	—

1	2	3	4	5
50. Country languages	x	x	x	x
51. Palanquin dressing	x	–	–	–
52. Art of mechanic appliances	x	–	–	–
53. Memorising	x	–	–	–
54. Multi-lingual poetics	x	–	x	–
55. Lexicology	x	x	–	x
56. Metrical poetics	x	x	x	x
57. Rheotrics	x	–	–	x
58. Masquerading	x	–	–	–
59. Gambling	x	–	x	x
60. Chess and Dice play	x	x	–	x
61. Bed-dressing	x	–	–	–
62. Wood craft	x	–	–	x
63. Playing with children	x	–	–	–
64. Drawing	x	x	x	x
65. Conceit	–	x	–	–
66. Knowledge	–	x	–	–
67. Science	–	x	–	–
68. Water-sustaining	–	x	–	–
69. Music-in-motion	–	x	–	–
70. Music timing	–	x	–	–
71. Science of rains	–	x	–	–
72. Fruit-crops	–	x	–	–
73. Art of concealment	–	x	–	–
74. Religiosity	–	x	–	–
75. Last rites	–	x	–	–
76. Art of commerce/trade	–	x	–	–
77. Samskṛta prattling	–	x	–	–
78. Religious practices/rituals	–	x	–	–
79. Frolicity	–	x	–	x
80. Science of horse/elephant	–	x	–	x
81. Science of men/women	–	x	–	x

1		2	3	4	5
82.	Scriptology	–	x	x	x
83.	Instantaneous intelligence	–	x	–	x
84.	Cupidology	–	x	x	x
85.	Cherishing	–	x	–	–
86.	Āyurveda	–	x	x	–
87.	Pottery	–	x	x	–
88.	Collyrium-making	–	x	x	–
89.	Digestive powders	–	x	–	x
90.	Handicrafts	–	x	–	–
91.	Art of speech	–	x	–	–
92.	Story telling	–	x	–	–
93.	Milling rice	–	x	–	–
94.	Art of Satire	–	x	–	–
95.	Manual labour treatment	–	x	–	–
96.	Hosuehold traditionalism	–	x	–	x
97.	Grammar	–	x	–	–
98.	Hair-dressing	–	x	–	x
99.	Mathematics	–	x	–	–
100.	Cavilation	–	x	x	–
101.	Civics	–	x	x	–
102.	Scriptures	–	–	x	–
103.	Literature	–	–	x	x
104.	Palmistry	–	–	x	x
105.	Hand-to-hand fighting	–	–	x	–
106.	Mineral knowledge			x	x
107.	Proficiency in horse, elephant and chariots	–	–	x	–
108.	Fire reflection	–	–	x	–
109.	Speech retention	–	–	x	–
110.	Age retention	–	–	x	–
111.	Stimulation art	–	–	x	–
112.	Art of attraction/Water retention/Arts of figure of speech	–	–	x	–

1	2	3	4	5
113. Art of stupefaction	–	–	x	x
114. Art of detraction	–	–	x	–
115. Incantational root-out	–	–	x	–
116. Science of killing	–	–	x	–
117. Tuine-tricks	–	–	x	–
118. Art of entering others body	–	–	x	–
119. Sandal accomplishment	–	–	x	–
120. Vocal accomplishment	–	–	x	–
121. Beadal accomplishment	–	–	x	–
122. Deceptive sighting	–	–	x	–
123. Deceptive voice	–	–	x	–
124. Gemal/Medicinal accomplishment	–	–	x	–
125. Theft/Burglary	–	–	x	–
126. Blacksmithy	–	–	x	x
127. Stone-craft	–	–	x	x
128. Leather-craft	–	–	x	–
129. Invisiblisation	–	–	x	–
130. Dentistry	–	–	x	–
131. Animal husbandry	–	–	x	–
132. Hunting	–	–	x	–
133. Agriculture	–	–	x	x
134. Fermentation	–	–	x	x
135. History	–	–	x	–
136. Repudiatory tact	–	x	–	–
137. Special dressing	–	x	–	–
138. Art of equitability	–	x	–	–
139. Veena-playing	–	x	–	–

It could, thus, be inferred that, here too, the topics and subjects have changed from time to time. It may be surmised that the concept of 64 arts for women developed later than general 72 arts.

As with worldly learnings for men, the women arts may also be classified under current faculty as in Table 9. These subjects comprise twelve faculties. A comparative evaluation of learnings for men and women has been given in Table 10.

Table 9 : Facultywise Classification of Arts for Women.

1. Canonical and Religious Studies

1. Scriptures
2.-3. Religion and religious practices
4. Religious rituals

2. Humanities

(a) Language, Literature and Linguistics
1. Grammar
2. Meterology
3. Lexicology
4. Legendary stories
5. Scriptology
6. Country languages
7. Literature
8. Poetics
9. Phonetics
10. Riddlery
11. Last lettery
12. Art of reading
13. Art of speech
14. Problematic compositions
15. Samskṛta prattling
16. Secret wording
17. Secret writing
18. Art of memorising
19. Instantaneous intelligence
20. Satires
21. Cavilation

(b) 1. Arts of Trade (Commerce & Economics)
2. Manual labour treatment

(c) 1. Politics
2. Civics
3. Science of justice

(d) 1. History
2. Household tradition

(e) Music and Fine Arts
1. Dramatics
2. Dancing
3. Painting
4. Vocal music
5. Instrumental music
6. Drawing
7. Drum playing
8. Music timing
9. Music motion
10. Time tricks

3. Faculty of Abstract Sciences

1. General knowledge
2. General science

(a) Physics
1. Science of rains
2. Gemology

(b) Chemistry
1. Metal dressing
2. Mineral science
3. Fermentation
4. Art of perfumery

(c) Mathematics

4. Faculty of Life Science

(a) Botany

(b) Zoology
1. Science of men and women studies
2. Science of horse and elephant studies

5. Faculty of Engineering and Technology

1. Leather-craft

2. Textiles and Dyeing
3. Blacksmithy
4. Rice milling
5. Handicrafts
6. Pottery and ceramics
7. Woodcraft
8. Bamboo craft
9. Enamelling
10. Stone craft
11. Civil engineering
12. Mechanical appliances

6. Faculty of Home Science

1. Cosmetics
2. Food Science
3. Science of soft/medicated drinks
4. Science of bed-dressing
5. Engraving
6. Embroidery
7. Beautification
8. Head dressing
9. Flower dressing
10. Surface dressing
11. Flower bedding
12. Dress wearing
13. Dress making
14. Flower cresting
15. Knitting and weaving
16. Ornamentation
17. Ear dressing
18. Palanquin dressing
19. Masquerading
20. Proficiency in horse, elephant & chariot
21. Deceptive voice
22. Deceptive sighting
23. Hair dressing

24. Special dressing
25. Parrot messengering
26. Finger tipping

7. Faculty of Physical Education & Sports

1. Gambling
2. Chess and dice play
3. Hunting
4. Water sports
5. Physical sports
6. Playing with children
7. Art of frolicity
8. Cock-sheep-portridge fighting

8. Faculty of Agriculture

1. Crop production
2. Gardening
3. Fruit crop
4. Animal husbandry

9. Faculty of Āyurvedic Medicines

1. Āyurveda system
2. Digestive powder making
3. Dentistry
4. Annointing and massaging
5. Stimulation
6. Collyrium making
7. Cupidology

10. Faculty of Prognostics and Supernatural or Surprising Arts

1. Science of omens
2. Palmistry
3. Art of characterising
4. Science of incantations
5. Science of mystical diagrams
6. Science of invisiblisation
7. Gemal and medicinal accomplishment

8. Beadal accomplishment
9. Incantational root out
10. Supernatural killing
11. Art of stupefaction
12. Art of detraction
13. Art of fire retention
14. Art of age retention
15. Art of speech retention
16. Art of water spouting
17. Art of attraction
18. Art of concealment
19. Art of cherishing desires
20. Science of jugglery
21. Science of magic
22. Vocal accomplishment
23. Art of entering other's body

11. Faculty of Military Sciences

1. Hand-to-hand fighting

12. Miscelleny

1. Art of Equitability
2. Art of repudiatory tact
3. Art of conceit

4-5. Art of theft and last rituals

It is noteworthy that *Vidyānuvāda Pūrva*[14] mentions 700 minor learnings, 500 major learnings and 8 prognostics and *Āvaśyaka Cūrṇi*[15] states about 48,000 learnings. The current listings, however, seem to be too small in number. It seems the total may not exceed 250 combined for men and women. In view of this current canonical descriptions, the above mention seems to be little off the track unless names and details about them are found. Researchers have high responsibility to verify the above statement. However, whatever the canons have, is also enormous and a man or woman cannot master in his or her single life time.

Comparative Evaluation of Worldly Learnings

The description given above regarding the different faculties and subjects of learning in general and for woman suggests that there were twelve faculties under which 139 to 191 subjects were taught during the period under consideration as shown in Table 10. This may be quite comparable to the listings of the university of Cincinnati, Ohio, U. S. A. (one of the most developed countries of the world) where 150 subjects are mentioned under 11 faculties. However, the varieties and names of the subjects must vary as has been shown even in early days. Many subjects have lost importance, gone out of date and many new ones have been added. The contental status of many practical subjects has also been raised enormously. It is now attempted that there should be threading between the ancients and modern status of learning so as to measure the growth of knowledge fronts.

Table 10 suggests that the learning in canonical age had two important faculties – those of prognostics and supernatural or surprising arts which involve about 20·% of the total subjects. These two faculties are not found in the educational system of the current age. It is also clear that men had to learn many more of such subjects per chance for impression. Though traditionalists have still sufficient faith in them, however, most of them elude scientific verification.

Table 10 has quite a number of points to indicate the difference between learnings of men and women. The women studied some scriptures but no Vedas as they are not mentioned in their list. However, they had to study many more language arts in comparison to many aboriginal languages. They had to learn very small number of science subjects but a large number of Home Science subjects alongwith agriculture and technical arts. In contrast, men had to be proficient in various Military science subjects. It is surprising that though men and women learnt chess, dice plays and gambling, but hunting, water sports and physical exercises are mentioned

only for women. Similarly, it is seen that women of those days had also to learn architecture and Civil engineering.

Table 10 : Number of subjects in different faculties for general and women studies.

Faculties	General		Women	
	Deptts.	Subjects	Deptts.	Subjects
1. Vedic and Religious Studies	3	8	4	4
2. Humanities	6	46	6	38
3. Abstract Sciences	3	40	4	10
4. Life Sciences	2	11	2	3
5. Āyurveda	4	9	3	7
6. Home Sciences	2	5	3	26
7. Engineering and Technology	3	11	3	11
8. Physical Education	4	7	6	8
9. Agriculture	—	—	4	4
10. Prognostics and Surprising Arts	8	38	3	22
11. Military Science	—	16	—	2
12. Miscellaneous	—	—	—	5
	35	191	38	140

However, the different types of arts mentioned for women indicate that they must be clever and intelligent enough to meet any odd situations they could be in. The list of their home science and supernatural subjects confirms this statement.

The subject difference for men and women does not mean that all subjects were learnt by education by every man or woman. Of course, it could be desirable to learn as many subjects as possible to lead a successful and pleasant life. Men or women could be trained in any of the subjects and faculties of their interest.

It may also be guessed that these arts were learnt by

well-to-do women of the day in general rather than common women.

It could also be noted here that there is not much variation in number of arts for women being fixed at 64, there is a large number of variation of arts for men. The minimum mentioned is 48 in *Nāyakumāracariu* of Puṣpadanta. Somadeva mentions 64 while the canons mention 72 and *Samavāyāṅga* can be treated as to go upto 86 as detailed earlier. This suggests constant changing pattern of not only the number but additions and modifications from time to time.

Superworldly Learnings

The wordly learnings of different types made the men and women capable of earning their livelihood and work towards betterment of themselves and the society. However it must be noted that these learnings started at a later stage. What was the early education ? The answer would be the learnings about subjects consisting contents of superworldly nature.

Bhagavatī mentions about many early ceremonies of children like tonsure, sacred threading and alphabetical beginning at proper ages. These represent inculcation of some religious spirit in children. However, proper superworldly education started at some higher age under saintly scholars. When pupils had an urge for it, they had to accept certain formalities like celibacy and other vows. They had much to practice than learn.

However, there were two types of texts to be learnt by them. The first types are called primary or *Aṅga* texts – twelve in number – one being lost to memory – hence now eleven. The other types are called secondary – without *Aṅga* texts. Their number varies between 14 to 72. They are extensions of primary texts and elaborate their contents in different ways. However, one can have their preliminary studies to make one's life ethically sound for better worldly living.

It must, however, be pointed out that these super-

worldly texts have worldly contexts also to elaborate the nature of the world system and its ways. A good proportion of them describe these contexts through legends, history, stories and other general descriptions. They indicate men and women about their duties and efforts to make themselves capable of spiritual growth. Thus, superworldly learnings should not be taken as exclusive but it is inclusive of worldly learnings also. The worldly learnings form a part and parcel of these learnings. They are invariably connected. They are, however, taught by religious teachers instead of other two classes of teachers.

Scope of Current Studies

The current studies will involve only those subjects which come under physical sciences and life sciences, home science and medicine. It must be apprehended that the early literature does not prove to have had watertight classification of subjects or branches as it is today. It is observed that every important text of canonical period involves contents covering many branches of learnings. *Bhagavatī, Samavāyāṅga* and *Sthānāṅga* are said to be encyclopedial in nature. An attempt, therefore, will be made to sort out the early material subjectwise and arrange it with historical perspective for proper evaluation.

References

1. (a) *Bhagavatī Sūtra*-1, Jaina Bhavan, Calcutta, 1974, p. 152.

   (b) *Ibid,* Sadhumargi Jaina Sangha, Sailana, 1967, p. 1690.

2. (a) *Sūyagaḍo*-1, Jaina Vishva Bharati, Ladnun, 1984, p. 158.

   (b) Ed. Yuvācārya Mahāprajña, *Ṭhāṇāṅga,* Jaina Vishva Bharati, Ladnun, 1979, p. 232.

3. *Ibid,* p. 355.

4. J. C. Sikdar, *Studies in Bhagavatī Sūtra,* Jainology Research Institute, Vaishali, 1964, pp. 327-387.

5. Nathulal Gupta, *Jaina-Bauddha Śikṣaṇa Paddhati,* Vishvabharti Prakashan, Nagpur, 1985, p. 57.
6. Ācārya Baṭṭakera, *Mūlācāra*-1, Bharatiya Jnanpitha, Delhi, 1984, p. 123.
7. Ācārya Puṣpadanta & Bhūtabali, *Ṣaṭkhaṇḍāgama,* Vedanā Section, S. L. Jaina Trust, Amaravati, 1949, p. 232.
8. *Ibid,* p. 232.
9. Ed. Yuvācārya Mahāprajña, *Samavāo,* Jaina Vishva Bharati, Ladnun, 1984, p. 154.
10. *Nandī Sūtra,* APS Beawar, 1982, p. 155.
11. *Jñātādharmakathā,* APS, Beawar, 1981, p. 48.
12. Gupta, *Jaina-Bauddha Śikṣaṇa Paddhati,* p. 70.
13. *Jñātādharmakathā,* p. 137.
14. *Ibid* (Introduction), pp. 15-22.
15. Bhaṭṭa, Akalaṅka, *Rājavārtika*-1, Bharatiya Jnanapitha, Kashi, 1953, p. 76.
16. Graduate Studies Bulletin, Cincinnati University, Ohio, U. S. A., 1992.

Chapter 4

Canonical Techniques of Objective Studies

Objects of Studies

There are infinite number of objects, things or topics for studies in the world. However, their proper studies could not be done until a proper classification and methodology is developed. *Bhagavatī* mentions unclassified list of 23-28 items for studies in a condensed manner which contains two broad classes : (a) visible and (b) invisible. There are said to be ten invisible objects to the common man and the rest being visible. They are shown as below :

Invisible Objects[1]	Visible Objects[2]
1. Medium of motion	1. Earth
2. Medium of rest	2. Oceans, dense oceans
3. Space	3. World regions
4. Soul	4. Hells
5. Physical atoms	5. Heavens
6. Sound	6. Time (*Samaya, Addha*)
7. Smell	7. Reals, Reality (*Astikāyas*)
8. Air	8. Colourations
9. Omniscience	9. Faith
10. Salvation capacity	10. Cognition
	11. Conation 12. Instinct
	13. *Karmas* 14. Activity
	15. Consciousness
	16. Body
	17. Parts and modes
	18. Realities (*Dravyas*)

The invisibles have to believed on the authority of all-knowing Jinas. The invisibility of smell and air is due to gaseous state. However, their liquid and solid forms have been proved to be visible. Similarly, the visibility of consciousness, cognition and conation, faith, hells and heavens is a matter worth rethinking.

These topics may also be classified in two ways (a) living and (b) non-living. Later on, all these topics were classified under six basic realities in the universe as below :

(a) Living

(b) Non-living – (1) Mattergy, (2-3) Medium of rest and motion, (5) Space and (6) Time.

Thus, the infinite objects involve only six variety of Reals which one could learn or study about.

Doors of Disquisitions : Aspective Studies

Dixit[3] seems to be right in saying that Jaina scholars were in the habit of 'Aspective Studies' about objects. They have gradually developed a ready-made list of such aspects. This development could be surmised from the descriptions available in canons of different periods. Not only this, one finds some parallel and seemingly unrelated lists in the two traditions. While Śvetāmbaras[4] have aspect listings from 10 to 36 finally culminating in 20 to 23, the Digambaras[5] have 6, 8 or 20 aspects from different considerations. Some lists have only aspects of living activities as the aim while others have general aspects as well. However, inclusive similarities could be traced in both types of lists. The Śvetāmbara lists are contained in *Bhagavatī*, *Prajñāpanā* and *Jīvābhigama* while Digambara lists are contained in *Ṣaṭkhaṇḍāgama*, *Niyamasāra*, *Mūlācāra* and *Tattvārtha-sutra*. Table 1 shows that the number of aspects varies in each text and Table 2 indicates that the names of aspects also vary therein with a final numerical agreement of 20 aspects in *Jīvābhigama* and *Mūlācāra*.

This aspectology of the Jainas is canonically termed as *Anuyogadvāra* system or a system of Doors of Disquisitions

(D. D.). The author prefers this term in preference to others by many authors. Of course, the word *Anuyoga* is a post-canonical term. Previously, *Nikṣepa* (Positings), *Adhigama* (Knowledge) and *Nyāsa* (Placement) terms were used for this meaning. The tabulated D. D. could be seen to suggest that they are related with physical and psychical or superphysical aspects, the ratio being nearly 2 : 1. Also, it is seen that the first and oldest attempt of *Bhagavatī* in this direction is chiefly based on physical (life span, body, activity, intake, respiration, instincts, births, etc.) aspects. The concept of soul seems to be not that important as later. The inclusion of many other disquisitions related with the living and non-living entities are extensions from time to time as the process of gaining knowledge could develop due to *karma* theory, self-realisation process and other concepts. That is why, at some stage, the doors of disquistions mainly represented life activities in their multi-farious formulations as in the case of spiritual stages (*Guṇa-sthānas*). It is due to this periodical development that one finds different numbers and names in different (and even in the same also) canonical or pro-canonical treatises. In *Ṣaṭkhaṇḍāgama* and *Mūlācāra,* even different traditions are also mentioned. Table 1 gives the numerical listings of disquisition doors in different chronological (assumed) canons suggesting that each has a list differing from the other either in number, name or tradition.

Table 1: Numerical Listings of Disquisition Doors in Some Canons.

No.	Source	No. of D. D.	Reference
1	**2**	**3**	**4**
1.	*Bhagavatī*	5	p. 211, (Positings 4, Quality 1)
2.	*Bhagavatī*	11	1. 2, pp. 35-45
3.	*Bhagavatī*	10	1. 5, p. 75
4.	*Bhagavatī*	11	9. 3, p. 1595

1	2	3	4
5.	*Bhagavatī*	20	8. 2, p. 1317
6.	*Bhagavatī*	36	25. 6, p. 3344
7.	*Prajñāpanā*	36	Vol. 1, 1 p. 13
8.	*Prajñāpanā*	27	Vol. 1, 3 p. 326
9.	*Prajñāpanā*	22	Vol. 2, 18 p. 326
10.	*Prajñāpanā*	10	Vol. 2, 13 p. 123
11.	*Jīvābhigama*	23	Vol. 1 p. 57
12.	*Jīvābhigama*	20	Vol. 3. 10 p. 1374
13.	*Ṣaṭkhaṇḍāgama*	14	Vol. 1,1.4 p. 33
14.	*Ṣaṭkhaṇḍāgama*	8	Vol. 1. 1. 7 p. 156 (*Ṣaṭ-saṅkhyādī*)
15.	*Mūlācāra*	7	1, 5 p. 10,
		20	Body, Senses, Age, birth-place, species
		33	14 *Mārgaṇās* (Investigations) 14 *Guṇasthānas* (Spiritual stages)
16.	*Mūlācāra*	6	2, 707 p.11 (*Nirdeśa* etc.)
17.	*Mūlācāra*	20	2, 1045 p. 205 (*Paryāpti* chapter)
18.	*Niyama-sāra*	4	p. 31. Species, birthplaces,
		17	Living/ *Mārgaṇās* — 14
		42	p. 40. 14 species, 14 *Mārgaṇās* and 14 *Guṇasthānas*
19.	*Dhavalā*	7	Vol. 2, Instincts 10, 2. *Upayoga* 12,
		20	3. *Prāṇas* 10, 4. *Paryāptis*
		80	(Completions) 6, 5. Species 14, 6. 14 *Mārgaṇās*, 7. 14 *Guṇasthānas*
20.	*Dhavalā*	8	*Ṣaṭ-Saṅkhyādi*
21.	*Tattvārtha-sūtra*	2,4,6,8	1. *Pramāṇa-naya* 2. Positings 4

1	2	3	4
			3. *Nirdeśa* etc. 6
			4. *Ṣaṭ-saṅkhyādi* 8
22.	*Anuyogadvāra-Sūtra*	9	p. 68. 1. *Ṣaṭ-saṅkhyādi* - 8 *Bhāga* (proportion)-1
23.	*Anuyogadvāra-Sūtra*	6	p. 51. Positings - 4 Place and Time

It is noteworthy that *Ṣaṭkhaṇḍāgma* and *Mūlācāra* of Digambaras mention two traditions. The first being related with traditional canons, while the origin of the second is not clear. There are two types of second tradition — one of 8 D. D. in *Ṣaṭkhaṇḍāgama* and *Anuyogadvāra-sūtra* and the other of 6 D.D. as in *Mūlācāra*. The ADS mention of 8 or 9 and non-mention of canonical D. D. suggests that it is a composition later than these pro-canons — *Ṣaṭkhaṇḍāgama* and *Mūlācāra*. Secondly, mention of four doors in *Niyama-sāra* (17 or 30 by sub-classification) of Kundakunda[6] in place of seven (20 or 33 by sub-classification) in *Mūlācāra* suggests the later to be of earlier date. Thus, *Anuyogadvāra* should be later than Kundakunda or Baṭṭakera. Thirdly, the mention of the second tradition of D. D. differently in *Ṣaṭkhaṇḍāgama* and *Mūlācāra* indicates that they must have different sources, per chance, one western or northern (8) and the other southern (6). It seems that this tradition may have developed separately though its seedlings could be traceable in canonical D.D.'s. It is specific to the Digambara tradition followed by ADS. Many of these disquisition doors (upto 10-12) are included in 26 expository introductions in ADS (p. 459). This shows ADS has attempted to consolidate the variety of D. D.'s under one set which Umāsvāti seems unable to do as he mentions all sets separately, his commentators explaining this for the benefit of different disciplary standards[7].

It is observed, however, that these new sets of disquisition doors have a speciality of having general applicability for

learning about any object of living or non-living, visible or non-visible nature. The induction of topics of investigations (*Mārgaṇas*) or/and spiritual stages (*Guṇasthāna*) and others as disquisition doors was an intermediate stage during canonical period when only life activities became primarily important. The first list of *Bhagavatī* lead to this surmise. However, out of six or eight D. D. systems, the latter was preferred by Umāsvāti, Āryarakṣita, Pūjyapāda, Vīrasena and others while 6 D. D. system of *Mūlācāra* was overlooked. This seems to be reasonable as there is duplication in the lists as suggested by Jaina[8] recently as below. Moreover, the 8 D. D. system is more generalised by introduction of 'modal' door into it which the 6 D.D. system does not have. This 8 D. D. system does also involve the 4-6 positing systems and the valid cognition system. The 8 D. D. system does show a good amount of scientific approach.

Doors of Disquisitions in Different Sources

Table 2 gives a comparative list of canonical disquisition doors from different sources. The list, on consolidation, suggests that

(a) Canonically objects could be studied through 79 aspects.

(b) Many aspects seem to have synonymity as shown below :

(i) *Bhavyatva, Carama, Antakriya*	Salvation capacity
(ii) *Cāritra, Samyama, Samyata*	Restraint
(iii) *Prajñāpana, Sat, Nāma, Nirdeśa*	Naming
(iv) *Darśana, Samyaktva, Dṛṣṭi*	Faith
(v) *Kāla, Sthiti*	Life span
(vi) *Antara, Kāyasthiti*	Interval
(vii) *Jīva, Kāya, Jīvasthāna, Jīva-Samāsa-Vidhāna*	Classification, Taxology
(viii) *Parimāṇa, Sāṅkhya*	Numerical strength
(ix) *Upayoga, Paśyattā*	Consciousness
(x) *Avagāhana, Kṣetra*	Accomodation
(xi) *Paryāya, Viśeṣa, Bhāva*	Modes, modifications

Table 2 : Doors of Disquisitions in Jaina Canons* (*Anuyoga-dvāras*).

No.	Name	Saṁskṛta	B-1	B-2	B-3	B-4	B-5	P-1	P-2	P-3	J	S	N	M	ADS	U
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.	Life-span	*Sthiti*	x	x	x	x	x	x	–	–	x	–	–	x	–	–
2.	Spatial accommodation	*Avagāhana*	–	x	–	–	x	–	x	–	x	–	–	x	–	–
3.	Body	*Śarīra*	x	x	x	–	x	x	x	–	x	x	x	x	–	–
4.	Bone Joints	*Samhanana*	–	x	–	x	–	–	–	–	x	–	–	–	–	–
5.	Shape	*Samsthāna*	–	x	–	x	–	x	–	–	x	–	–	x	–	–
6.	Colouration	*Leśyā*	x	x	x	x	x	x	x	x	x	x	x	x	–	–
7.	Outlook	*Dṛṣṭi*	–	x	–	–	–	–	–	–	x	–	–	–	–	–
8.	Knowledge	*Jñāna*	–	x	x	x	x	–	x	x	x	x	x	x	–	–
9.	Activity	*Yoga*	x	x	x	x	x	x	x	x	x	x	x	x	–	–
10.	Consciousness	*Upayoga*	–	x	x	x	x	x	x	x	x	x	–	–	–	–
11.	Libido	*Veda*	–	–	x	x	x	x	x	x	x	x	x	x	–	–
12.	Passion	*Kaṣāya*	–	–	x	x	x	x	x	x	x	x	x	x	–	–
13.	Height	*Uccatā*	–	–	–	x	–	–	–	–	–	–	–	–	–	–
14.	Effort ·	*Adhyavasāya*	–	–	–	x	–	–	–	–	–	–	–	–	–	–
15.	Intake	*Āhāra*	x	–	x	–	x	x	x	x	x	x	x	x	–	–
16.	Respiration	*Śvāsocchvāsa*	x	–	–	–	–	x	–	–	–	x	–	–	–	–

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
17.	Karmas	*Karma*	x	–	–	–	–	x	–	–	–	–	–	–	–	–
18.	Colour	*Varṇa*	x	–	–	–	–	–	–	–	–	–	–	–	–	–
19.	Feeling	*Vedanā*	x	–	–	–	–	xx	–	–	–	–	–	–	–	–
20.	Instinct	*Sañjñā*	x	–	x	–	x	xx	x	x	x	x	x	x	–	–
21.	Birth, genesis	*Upapāta*	x	–	–	–	–	x	–	–	x	–	–	x	–	–
22.	Destinity	*Gati*	–	–	x	–	x	–	x	x	x	x	–	–	–	–
23.	Senses	*Indriya*	–	–	x	–	–	x	x	x	x	x	x	x	–	–
24.	Completioned	*Paryāpta*	–	–	x	–	–	–	x	x	x	x	x	x	–	–
25.	Fine	*Sūkṣma*.	–	–	x	–	–	–	x	x	–	–	–	–	–	–
26.	Births	*Bhāvastha*	–	–	x	–	x	–	x	–	–	–	–	–	–	–
27.	Liberatable	*Bhavya*	–	–	x	–	–	–	–	x	–	–	–	–	–	–
28.	Attainment	*Labdhi*	–	–	x	–	–	–	–	–	–	–	–	–	–	–
29.	Interval	*Antarkāyasthiti*	–	–	x	–	x	–	–	–	–	–	x	–	x	x
30.	Relative Strength	*Alpabahutva*	–	–	x	–	x	x	–	–	–	x	–	x	x	x
31.	Modification	*Paryāya, Pariṇāma*	–	–	x	–	x	x	–	–	–	–	–	–	–	–
32.	Time (sacred)	*Tīrtha*	–	–	–	–	x	–	–	–	–	x	–	–	–	–
33.	Identification	*Liṅga*	–	–	–	–	x	–	–	–	–	–	–	–	–	–
34.	Spatial Location	*Kṣetra*	–	–	–	–	x	–	–	–	–	x	–	–	x	x
35.	Time, Duration	*Kāla*	–	–	–	–	x	–	–	–	–	x	–	x	x	x

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
36.	Karmic Exp.	*Veda*	—	—	—	—	x	—	—	—	—	—	—	—	—	—
37.	Attachment	*Rāga*	—	—	—	—	x	—	—	—	—	—	—	—	—	—
38.	Conduct form	*Kalpa*	—	—	—	—	x	—	—	—	—	—	—	—	—	—
39.	Right Conduct	*Cāritra*	—	—	—	—	x	—	—	—	—	—	—	—	—	—
40.	Transgression	*Pratisevana*	—	—	—	—	x	—	—	x	—	—	—	—	—	—
41.	Kārmic Bondage	*Karmabandha*	—	—	—	—	x	x	x	—	—	—	—	—	—	—
42.	Conduct (attain)	*Ākarṣa*	—	—	—	—	x	—	—	—	—	—	—	—	—	—
43.	Extrication	*Samudghāta*	—	—	—	—	x	x	—	—	xx	—	—	—	—	—
44.	Conduct	*Sannikarṣa*	—	—	—	—	x	—	—	—	—	—	—	—	—	—
45.	Measure, Number	*Sāṅkhya, Parimāṇa*	—	—	—	—	x	—	—	—	—	x	—	—	x	x
46.	Modes (P/P)	*Bhāva*	—	—	—	—	x	—	—	—	—	x	—	—	x	x
47.	Naming	*Prajñāpanā, Sat*	—	—	—	—	x	x	—	—	—	—	—	—	x	x
48.	Restraint	*Samyama*	—	—	—	—	x	x	x	x	—	x	x	x	—	—
49.	Prematuration	*Udīraṇa*	—	—	—	—	x	—	—	—	—	—	—	—	—	—
50.	Loss of Gains	*Upasampat-Hana*	—	—	—	—	x	—	—	—	—	—	—	—	—	—
51.	Contact area	*Sparśana*	—	—	—	—	x	—	—	—	—	x	—	x	x	x
52.	Position, station	*Sthāna*	—	—	—	—	—	x	—	—	—	—	—	—	—	—
53.	Specification	*Viśeṣa, Paryāya*	—	—	—	—	—	x	—	—	—	—	—	—	—	—
54.	Birthplace	*Yoni*	—	—	—	—	—	x	--	—	—	—	x	x	—	—

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
55.	Last birth	*Carima*	–	–	–	–	–	x	x	x	–	–	–	–	–	–
56.	Right faith	*Samyaktva*	–	–	–	–	–	–	x	x	x	x	x	x	–	–
57.	Descendance	*Cyavana, Gati-Agati*	–	–	–	–	–	–	–	–	xx	–	–	–	–	–
58.	Direction	*Diśā*	–	–	–	–	–	–	x	–	–	–	–	–	–	–
59.	Living	*Jīva, Kāya*	–	–	–	–	–	–	x	x	–	x	x	x	–	–
60.	Righteousness	*Samyaktva*	–	–	–	–	–	x	x	x	–	x	x	x	–	–
61.	Mattergy	*Pudgala*	–	–	–	–	–	–	x	–	–	–	–	–	–	–
62.	Destinities	*Mahādaṇḍaka*	–	–	–	–	–	–	x	–	–	–	–	–	–	–
63.	Speech, Language	*Bhaśaka*	–	–	–	–	–	x	x	x	–	–	–	–	–	–
64.	Liberality	*Parita*	–	–	–	–	–	–	x	x	–	–	–	–	–	–
65.	Existential Ext.	*Astikāya*	–	–	–	–	–	–	x	x	–	–	–	–	–	–
66.	Spiritual Stages	*Guṇasthāna*	–	–	–	–	–	–	–	–	–	x	x	–	–	–
67.	Liberatability	*Bhavyatva*	–	–	–	–	–	–	–	–	–	x	x	x	–	–
68.	Species	*Kula*	–	–	–	–	–	–	–	–	–	–	x	x	–	–
69.	Naming	*Nāma-nirdeśa, Sat*	–	–	–	–	–	–	–	–	–	x	–	x	–	x
70.	Cause, Prep.	*Sādhāna*	–	–	–	–	–	–	–	–	–	–	–	x	–	x
71.	Ownership	*Svāmitva*	–	–	–	–	–	–	–	–	–	–	–	x	–	x
72.	Proportion	*Bhāga*	–	–	–	–	–	–	–	–	–	–	–	–	x	–
73.	Durational, Interval	*Kāyasthiti*	–	–	–	–	–	x	–	–	–	–	–	–	–	–

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
74.	Last effort for liberation	*Antarkriyā*	–	–	–	–	–	x	–	–	–	–	–	–	–	–
75.	Feeling Bonding	*Veda-bandhaka*	–	–	–	–	–	x	–	–	–	–	–	–	–	–
76.	Consciousness	*Paśyatta*	–	–	–	–	–	x	–	–	–	–	–	–	–	–
77.	Sex-activity	*Pravicāra*	–	–	–	–	–	x	–	–	–	–	–	–	–	–
78.	Clairvoyance, ESP	*Avadhi konwledge*	–	–	–	–	–	x	–	–	–	–	–	–	–	–
79.	Activity`	*Prayoga, Yoga*	–	–	–	–	–	x	–	–	–	–	–	–	–	–
		TOTAL	11	10	20	11	36	36	27	22	22	27	18	27	9	8

*B-1 — B-5 : *Bhagavatī* 1.2, 1.5, 8.2, 9.3, 25.6 P-1 — P-3 : *Prajñāpanā* 1.1, 1.3, 2.18

J : *Jīvābhigama* 1, p. 57 S : *Ṣaṭkhaṇḍāgama* N : *Niyamasāra*

M : *Mūlācāra* ADS : *Anuyogadvāra-sūtra* U : *Tattvārtha-sūtra*

x : Inclusion – : Exclusion

NOTE — There are some differences and repetitions in many references.

(c) Many aspects seem to be duplications :

(i) *Saṅghāta,* (ii) *Sañjñā-Sañjñī* (instincts), (iii) *Veda* (Libido), (iv) *Kāla.*

If these synonyms and duplications are regularised, one can find that there could be about fifty aspects for knowing about any object. The present generation is not in a position to explain such a variety of names except to say that communication gap and different periodical insertions might have led to the current state of affairs. The present canonical scholars should look into the co-ordination in this regard for the younger generation. Kapadia has not dealt with this point[9].

(d) It is observed that 6/8 aspect tradition of *Ṣaṭkhaṇḍāgama* and *Mūlācāra* are indirectly involved in later canons. The *Bhagavatī* and *Prajñāpanā* seem to be unknown to these systems. As stated earlier, these systems are shown in Table 3 on comparative basis and the readers could draw their own conclusions despite author's expressions.

Table 3 : 6/8 Disquisition Doors.

6-system	8-system	Scientific system
Naming (*Nirdeśa*)	Existential naming (*Sat*)	Name
Preparation (*Sādhana*)	—	Preparation methods
Classification (*Vidhāna*)	Number, Relative strength	Properties
Substratum (*Adhikaraṇa*)	Abode, pervasion (*Kṣetra, Sparśana*)	Properties
Duration (*Sthiti*)	Duration, Interval (*Kāla, antara*)	Properties
Ownership (*Svāmitva*)	Physical/mental modes (*Bhāva*)	Uses

(e) The development of topics of Investigations (Mārgaṇās) seems to have post-canonical origin. The spiritual stages have also the same fate though traces of their develop-

ment exist in canons. The classification of living ones also seems to have the same track which starts with six living species.

(f) It is observed that most texts under reference contain more than one list of D. D.'s in different sections. This is also the case for many more descriptions. This has led to some logical suggestion by recent authors :

(i) Most canons are authored by many ācāryas of different periods.

(ii) The different listings suggest periodical interpolations and corruptions in original texts.

(iii) The canons are supposed to be consistent. The different listings and descriptions on any single topic in different parts of the same book or different books contain their consistency. This fact, therefore, should be interpreted in a better logical way with historical perspective.

These suggestions should be checked and verified with proper seriousness to alleviate faith erosion in canons.

Overall Doors of Disquisition

Despite later predominance of 8 D. D. system, one should look into the canonical disquisitions whether they represent the specific points of 8 D. D. system. As said before, the 80 odd D. D.'s of Table 2 can be consolidated into the 8-door system also as shown in Table 4. It is observed that most of the disquisition doors come under the physical and psychical category of modal disquisition. Secondly, while most of disquisitions are related with the living entities, there are some which refer to all type of entities. Thus, Akalaṅka has illustrated the non-living on the basis of these doors[10]. It is these doors which are most interesting to us in modern times.

Jaina's equation of these doors has already been pointed out. Umāsvāti has illustrated that quantitative studies could also be made about the objects alongwith qualitative ones. However, it could now be borne in mind from Table 3

that even in olden days, the categories of aspects were nearly the same as current though their horizons might have broadened.

Table 4 : Different Disquisition Doors under 8 D. D. System.

1.	Existential Naming (*Sat*)	*Prajñāpanā, Astikāya, Sādhāna, Sat, Nirdeśa*
2.	Sāṅkhya (Numeration)	*Dravyapramāṇa, Vidhāna, Kāya, Jīvasamāsa,* Quantity, *Akarṣa*
3.	Spatial Location (*Kṣetra*)	*Kṣetra, Avagāhana,* Height, Fineness, Position, Direction, *Daṇḍaka* (Places of kārmic realisation), *Adhikaraṇa*.
4.	Pervasion/Contact area (*Sparśana*)	*Sparśana*
5.	*Kāla* (duration, time)	*Kāla, Sthiti* (life-span), *Tīrtha*
6.	Interval (*Antara*)	*Antara, Kāya-sthiti*
7.	Relative Strength (*Alpabahutva*)	*Bhāga* (proportion), *Alpabahutva*
8.	Modes (*Bhāva*)	*Physical* Modification (*Pariṇāma, Viśeṣa, Paryāya*), Shape, Bone-joints, Sex (*pravīcāra,* sex-pleasure), Intake, Respiration, Colour, Instincts, Speech, Senses, Completions, Birth, Birth-places, Species, Expansion, *Pudgala,* Attainments, Identification, *Kalpa* (form, conduct), Destinity (Chyavan), Ownership. *Psychical* Colouration, Passion, Activity, Consciousness (*Paśyatta*), Feeling (feeling, feeler), Kārmic bondage, Kārmic feeling, Kārmic prematuration, Attachment, Restraint (*Caritra, Sannikarṣa*), Spiritual stages, Libe-

ratability (Bhāvaparita, Caram, Antakriya, bhāva-siddhikā), Knowledge, Avadhi, Trangressions (*Pratisevana*), Loss of Gains (*Upasampat-han*), Right faith (Outlook, *Darśana*), Feeling-bonding.

Cognitive Processes for Objective Studies

The different aspective studies are to be carried out through some cognitive processes. *Bhagavatī-sūtra* and *Rājapraśnīya* are the early canons mentioning five types of cognitions – Sensory (*Mati*), Scriptural (*Śruta*), Clairvoyance (*Avadhi*), Telepathy (*Manaḥ-paryaya*) and Absolute (*Kevala*). The major objective studies are made and catalysed by sensory and scriptural cognitions. There is quite a good description about them in canonical and post-canonical literature. The sensory knowledge about objects is most important and is said to consist of five stages shown in Table 5. These stages are virtually equivalent to the current five scientific steps for obtaining knowledge mentioned in Table 5 too. This makes it clear that the canonical or post-canonical period has been utilising the same processes as used today. Moreover, despite the fact that there was no instrumentation in those days there was high intellectual acuteness as shown by classification of sensory knowledge in 336-456 types[11]. It was agreed that the knowledge will be exact when senses, mind, light and other auxilliary causes are normal. This is the basis of canonical descriptions about the physical phenomena. It is, therefore, highly interesting to compare the canonical and current descriptions. It could be expected that there should not be much difference in both types of descriptions due to similar processes being adopted. Jaina has, however, shown that the canonical descriptions are more of physical and qualitative nature. Barring few cases, there seems to be not much fineness there. There seems to be sufficient gap between these two descriptions. However, L. C. Jaina[12] has shown that historically, the

Table 5 : Five Stages of Sensory Knowledge.

No.	Stage	Definition	Nature	Function	Scientific Equivalent
1.	Perception/Conation (*Darśana*)	First sense-object contact	Physical	Indistinctness	Experiment
2.	Apprehension (*Avagraha*)	Repeated sense-object contact	Physical-cognitive	Perception/ cognition	Observation
3.	Speculation (*Īhā*)	Identification process about object	Mental	Analysis	Classification
4.	Perceptual Judgement (*Avāya, Apāya*)	Intellectual Identification of Object	Mental	Judgement	Inference
5.	Retention/Recording (*Dhāraṇā*)	Memorising/recording the inferences	Cognitive	Retention/ recording	Communication, hypothesis.

Jainas stand better in many concepts.

There are three basic concepts of the Jainas on which their theory of knowledge is based and which might be the gapping sources. They need elaboration with reference to current concepts :

(i) The eyes and mind are non-contactile. They do not have contact with objects for knowledge.

(ii) The eyes see grosser objects in comparison to other senses.

(iii) There are perfect souls which are omniscients. They observe all the phenomena all the times accurately.

The non-contactility of eye is a canonical concept[13]. It seems to be based on point (ii) mentioned above. Scientists, however, say that the eye works like a camera which works in the presence of light (normal or infra-red) through indirect contact with the object. Thus, non-contactility should mean indirect contactility. The scientists proclaim that even the darkness is a form of light outside the human visibility range and within the range of cat or owls. Similarly, the brain or physical mind is working more indirectly than eye. It must receive sensations before it works.

The second concept also does not seem to be wholly correct[14]. Actually, it is the eye and visual instruments which determine the fineness. The other senses have molecular contacts only.

The concept of omniscience of Mahāvīra was disputed by Buddhists in his times. The concept seems to represent highest extrapolation of knowledgeability. The canons are recognised on this basis only. The major criteria of omniscience is consistency in descriptions with respect to logic and validity as Kundakunda points out in *Niyamasāra* and other treatises. However, the descriptions about astral world, redefining about many conceptual contents and others are the facts which suggest that this concept needs reconsideration and exami-

nation. Many scholars have expressed thought about this concept[15]. This attitude will lead the proper growth of knowledge. This leads to a more intelligible fact that the scriptures should not be taken as final word on any matter. *Uttarādhyayana* gives the new generation a pointer by asking one to analyse things by intellect[16]. The respect for sacred texts is as obstructive of true knowledge as the respect for the physical body and world. It is said that only that sacred text should be accepted as worth following which describes what is seen, heard, well thought and passes the intellectual test. Thus, they should be taken to represent and communicate about what is known and indicate about the new possibilities. They should be viewed with historical perspective for faith therein.

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16. (a) *Uttarādhyayana,* S. T. Mahasabha, Calcutta, 1967, p. 307.

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Section Two

Chemistry

The world of matter is chiefly described in Physics and Chemistry of today. While physics deals with gross matter and natural energies, chemistry deals with the definition, properties and classification of gross and fine matter, its transformation, structure, actions and reactions together with synthesis of new materials. In canonical days, the studies were limited to natural substances. A large amount of material is available in canons concerning these branches.

Attempts have already been made by many authors to present Jainological contents in stray manner. However, it has been found necessary to describe it in a comparatively comprehensive and coherent way. The following three chapters will deal with chemical contents followed by physical contents :

1. Reality and Matter : Definition, Properties and Classification.
2. Jaina Theory of Skandhas or Aggregations.
3. Jaina Thory of Atoms.

Chapter 5

Reality and Matter : Definition, Properties and Classification

Defining the Definition

The Jainas assume the world as real consisting of many realities. The realism is in contrast with the idealism of Vedāntins and Mādhyamic Buddhas. It is better realistic than Cārvāka or Nyāya-Vaiśeṣikas[1]. The various realities are commonly termed by different names like *Tattvas, Arthas, Padārthas, Tattvārthas* and *Dravyas.* These terms include most of the terms used in other Indian philosophies like *Padārthas* of Vaiśeṣikas, *Arthas* of Nyāya school and *Tattvas* of Sāṅkhya school. These have some difference in their meanings and number as well. This is shown in Table 1. For example, *Dravya* is one of the realities in Vaiśeṣika school while it is the common name for the reality in Jaina school. However, Umāsvāti must be given credit for retaining only two terms of *Tattva* and *Dravya* for the reality which have been followed by later Jaina scholars[2].

Table 1 : Realities in Major Indian Philosophies.

System	Name	Number	Classification		
			Living	Non-living	Qualities
1. Sāṅkhya	*Tattvas*	25	1	21	3
2. Vaiśeṣika	*Padārthas*	6, 7	1 (part)	1 (part)	5, 6
3. Nyāya	*Artha*	16	1 (part)	1 (part)	15
4. Buddhas	*Āryasatya*	4	—	1 (part)	3
5. Jainas	(a) *Dravyas*	6	1	4, 5	—
	(b) *Tattvas*	7	1	1	5
	(c) *Padārtha*	9-11	1	1	7, 8, 9

Prior to this, different canons used varied terms for

realities. *Uttarādhyayana* (*Tattva, Dravya*), *Sthānāṅga* (*Padārtha, Astikāya*), *Sūtra-kṛtāṅga, Bhagavatī, Samavāyāṅga* (*Astikāya*), Kundakunda (*Artha, Padārtha, Tattvārtha, Dravya, Astikāya*) have used different terms to mean the same realities. It is clear that Kundakunda's period was most varied in this respect. Reality is the english term used here preferably for these terms over the term substance as it traditionally connotes only the material nature of the reality.

The basic question here is — What is reality ? How to differentiate it from non-reals ? A definition is required for its distinctive identification from similar or dis-similar class. The canonical definition for reality has been developed through the ages. It has changed from reality as substratum of qualities to substratum of qualities or attributes and modes between canonical and Kundakunda period. However, these are the characteristics of reality and not proper definition.

Akalaṅka[3] has classified definition in two types — (i) basic or non-separable (*ātmabhūta*) like hotness of fire and (ii) non-basic, dissimilar or separable (*anātmabhūta*) like Deva-datta with a rod. Later on, it was classified in two other types — general and specific. The general definition is meant for identifying the class of substances on the basis of basic, natural or similar properties (*svarūpa-upādāna*). In contrast, the specific definition is meant for distinguishing one substance from another of same or different class on the basis of dis-similarities between them. This definitional classification is based on the assumption that every reality has an inherent quality and the change associated with it called modality. For example, colour is a general quality while white or black colour is a modality. Any coloured substance could be classified under similar definitional category but black or any specific coloured substance will be classified under dis-similarity-based category. Both of these qualities and modalities have generality and specificity. Devasena[4] and Maṇikyanandī[5] have illustrated these definitions in their own way leading to the same meaning.

However, it is noteworthy that while Devasena classifies definition with respect to quality and modes, the latter does it on the basis of generality and specificity of these factors. Though the latter seems to be better refined, we will follow Devasena because of its better illustrative nature as shown in Table 2 and 2A. The elaboration in defining the definition has led much refinement in the definition of reality in general and matter in particular by the Jainas.

Table 2 : Details of Definition (Devasena).

- Definition
  - Qualitative
    - General: 8 attributes (M), 11 attributes (A)
    - Specific: 16 attributes (M), 14 attributes (U/A)
  - Modal
    - Fine, Indistinct
      - Normal
      - Non-normal
    - Gross, Distinct
      - Normal
      - Non-normal

Table 2A : Details of Definition (Māṇikyanandī)

- Definition
  - General: 8 Attributes (Mallavādī), 11 Attributes (Akalaṅka, A)
    - Similarity based on qualities (*Sādṛśya-astitva*)
    - Similarity based on Modes (*Svarūpa-astitva*)
  - Specific: 16 Attributes (M), 14 Attributes (U/A
    - Dis-similarity based on qualities (*Paryāyas*)
    - Dis-similarity based on modes (*Vyatireka*)

Definition of Reality

The definition of reality has developed over a long period. Canons and Umāsvāti have played dominant role in it. Akalaṅka[6] described it literally by the term *'Dravya'* which is like a raw wood (*dāru*) which can undergo changes in shapes, size etc. This literalism is elaborated by the other terms used for it. However, we could define reality on the above-mentioned

definitional basis. Accordingly, it has been defined in three ways leading to same meaning.

Firstly, a reality may be defined as that which has some general and some special attributes. It can not exist without these attributes. The general attributes are called common properties, existential similarities, qualities, *tiryak-sāmānya,* co-existing and natural properties. The other types of attributes are called distinctive, specific, *viśeṣa, ūrdhvatā sāmānya, sva-rūpa-astitva, paryāyas* or modes. They may be co-existing or consecutive.

Akalaṅka[7] and Devasena[8] have mentioned 8-11 general attributes of reality shown in Table 3. It is clear that Devasena has better clarity in this respect where only eight of Akalaṅka's attributes fit in five of Devasena. He has not only repeatitive properties of 2-3 and 4-5, but it also has a gross discrepancy of omitting perceptibility attribute altogether and mentioning only upward motion rather than general one as an attribute.

Table 3 : General Attributes of Reality.

Akalaṅka (11)	Devasena (8)
1. Existence	1. Existence (Permanence)
2. Particulate nature	2. Particulate nature
3. Non-pervasiveness	—
4. Modifiability	3. Changeability
5. Bonding with modes	—
6. Permanence or eternality	—
7. Motion upwards	4. Motion or action (Functionality)
8. Non-perceptibility	5. Sense perceptibility or otherwise
9. Actorship (*Kartā*)	—
10. Enjoyer (*Bhoktā*)	—
11. Differentiation	—
—	6. Knowledgeability (*prameyatva*)
—	7. Weightlessness (Individuality)
—	8. Livingness or otherwise

Per chance, there might be some copying mistake here as Shastri[9] has suggested in one more case. However, he seems to have livingness or otherwise as specific property. This variation indicates that despite Malvania[10] accruing fifth century to Mallavādī, his opinion could not become prevalent during Pūjyapāda (mentioning only the first three followed by the word etc., fifth century)[11] or Akalaṅka (8th century) age. His period, therefore, requires reconsideration.

Table 3 indicates that all the realities have all the eight attributes with two alternatives — they will either be (i) living or non-living and (ii) with or without sense perceptibility. These are the co-existing qualities without which nothing could be called a reality. Akalaṅka's attributes mainly refer to the living reality.

Special Attributes

Devasena has also stated sixteen special attributes of realities. Out of which, six are attributed to material realities (touch, taste, colour, smell, form and non-livingness) as accepted by Umāsvāti[12] and six are attributed to living realities (*Knowledge of eight types, sight of four types, energy of two types*, happiness of two types, livingness and formlessness or sense imperceptibility). These are also co-existing properties. Auxiallary casuality in motion, rest, change and accommodation are the other four specific properties attributed to non-material and non-living realities.

In contrast, Umāsvāti[13] has five specific properties of living realities in terms of volitional activities due to subsidence, destruction, subsidence-cum-destruction of *karmas,* rise of *karmas* and inherent nature like livingness. The first four of these are causes of the first four of Devasena. These together with livingness may be taken,as equivalent to his five specific ones. Akalaṅka does not mention formlessness as a specific property of the living reality.

The non-material and non-living realities have formlessness and non-livingness as two common specific properties.

Moreover, each reality has a third uncommon attribute out of the four mentioned above. The details of specific properties are given in Table 4 which indicate that formlessness makes the difference between the two authors. There is one more point worth mentioning here. Despite the fact that Pūjyapāda[14] has defined forms as consisting of aggregation of touch, taste, smell, colour and shape, the separate mention of form leads one to conclude that Devasena differentiated between form and other four qualities. Secondly, inclusion of form or otherwise in both types of qualities seems to be a repeatition. Similar is the case with qualities of livingness or otherwise. These are specific to specific categories. It would have been better, had they not been included in the general attributes by Devasena.

Natures of Realities

The duality of reality has been described in one more way by Devasena[16]. The nature of reality may be general with 11 varieties and special with 10 varieties as shown in Table 5.

Table 4 : Specific Attributes of Realities.

Reality	Akalaṅka/Umāsvāti[15]	Devasena
Living	1-5. Volitional activities due to	Knowledge, conation
	(i) Subsidence of *Karma*	Energy
	(ii) Destruction of *Karmas*	Happiness
	(iii) Combination of (i) & (ii)	Livingness
	(iv) Rise of *Karma*	Sense-imperceptibility
	(v) Inherent properties (like livingness)	
Non-living Material	6 Touch, taste, colour, smell, shape/form Non-livingness	6Touch, taste, colour, smell, shape/form Non-livingness
Non-living non-material	1-4 one of the four causalities Non-livingness	1-4 one of the four causalities Non-livingness Formlessness

All types of nature total 21. The natures in general consist of qualities or modes representing the existing present or permanent form, appearance or mode of the reality. Outwardly, there seems to be no co-relation between the earlier attributes and these natures. But, on closer examination, one can find sufficient equivalence together with some discrepancies from the earlier attributes. For example, the first six special natures are general attributes of Table 3. The last five general and the last four special natures show some repeatition and specificity from Table 5.

This generality-cum-specificity of reality represents another definition of reality as possessing qualities and modes. The living and material realities have all the 21 natures. The realities of medium of motion, rest and accommodation have 16 natures. The reality of time has only 15 natures.

Table 5 : Natures of Realities.

General Natures 11	Specific Natures 10
1. Permanence	Conscious Nature
2. Modifiability	Non-conscious Nature
3. Existentiality	Formlessness
4. Non-existentiality	Formness
5. Uni-naturality	Uni-particulateness
6. Multinaturality	Multi-particulateness
7. Differentiality	Absolute nature
8. Identity	Non-absolute nature
9. Salvation capacity	Denaturation capacity (*Bibhāva*)
10. Salvation incapacity	Empirical nature
11. Inherence	

Existentiality as Reality

A third and basically simplest definition of reality has been given by Umāsvāti[17]. A reality is that which is *Sat* or existential. This existence has been defined as that which could be produced and destroyed despite maintaining its basic nature or it has changeability through permanence. The gold

and its ornaments are cited as examples in this regard. This definition is also akin to the earlier ones as changeability refers to specific properties or modes and permanence to qualities. These terms have been generalised by Umāsvāti in an aphorism stating that a reality consists of qualities and modes. It is, thus, a substratum for them. This definition represents synthesis of the exclusivists like Buddhas and Vedāntin's opinion[18]. This definition is ahead of *Uttarādhyayana*[19] which specifies a reality with qualities only and is suggestive of Vaiśeṣikas influence. Jaina[20] has referred the periodical modification of the definition of reality in *Uttarādhyayana, Pravacansāra* and *Pañcāstikāya.* Amṛtacandra[21] has qualified reality with length and breadth. While the breadth represents coexisting attributes, the length represents consecutive attributes.

The existential definition is highly peculiar to Jainas and it has made the definition of other realities as defectless as possible.

Based on the above properties of general and specific attributes, qualities and modes or existentiality, one is in a position to define reality in a more concrete form. Accordingly, it can be defined as an entity consisting of aggregation or combination of eight general and 3-6 specific attributes, 15-21 natures and existential characteristics. It means that a reality in Jaina philosophy is neither a particularity nor a universality exclusively, but it is a synthesis of both these types as Mehta has pointed out. Padmarājaiyā[22] has stated these attributes in terms of their static and dynamic nature and has mentioned the reality to consist of a blend of both of them. It does not have any exclusive nature. This definition has accommodated all these types of attributes and has been made as accurate as possible.

The Vaiśeṣikas are also credited for defining their reality of *Dravya* (material and non-material) which is an entity virtually equivalent to Jaina realities inclusive of the living and non-living. They define it as an entity having action or motion, quality and

inseparable causality in efforts[23]. The Jainas agree to this definition except the fact that they maintain the four basic qualities of touch, taste, smell, and colour as coexisting rather than otherwise. These and other qualities are inherent and inseparable from the reality. This is in contrast with the Vaiśeṣikas who agree qualities as a separate reality[24]. Jainas postulate their view on the basis of polyviewism and remove many discrepancies in characterisation of the reality. Sikdar[25] has equated the property of action of Vaiśeṣikas as modification in qualities of Jainas.

However, despite the similarity of definition of quality as such, the Vaiśeṣikas seem to have large difference in enumerating them as shown in Table 6[26]. They agree to 24 or 27 (modified) qualities including three sub-class of *samskāra* (trait) and two of *Adṛṣṭa* (divinity) and liquidity at present. They have 11 general and 16 special qualities while the Jainas have 10 general and 16 special ones. Despite this nearly numerical similarity, Table 6 makes it clear that it would be very difficult to compare and contrast these qualities except the fact that the Jainas agree to touch, taste, smell and colour coexisting in material bodies and happiness, knowledge, sight and energy/effort to the living bodies. They also agree to quantity (fine, gross), combination (bond), decombination (division), sound, action, gravitation, liquidity, separation and number indirectly in different contexts[27]. Despite this difference, Vaiśeṣikas description of similarities and dis-similarities is noteworthy.

Table 6 : Qualities in Jaina and Vaiśeṣika Philosophies.

Jainas	Vaiśeṣikas
(a) General Qualities	
1. Existence or Permanence	Number
2. Particulate nature	Quality/measure
3. Motion/action	Differentiality/separation
4. Sense perceptibility	Combination
5. Sense imperceptibility	Decombination

6. Weightlessness	Distantness
7. Livingness	Nearness
8. Non-livingness	Gravitation
9. Changeability	Liquidity (casual)
10. Knowledgeablity	Velocity
11. —	Elasticity
(b) Specific qualities	
(i) Material qualities	
1. Touch	Touch
2. Taste	Taste
3. Colour	Colour
4. Smell	Smell
5. Form	Viscosity
6. Non-livingness	Liquidity (Natural)
7. —	6 from above (6-11)
(ii) Non-material Qualities	
1. Livingness	—
2. Knowledge	Intelligence
3. Happiness	Happiness
4. Energyness	Effort
5. Formlessness	—
6. Sight	—
7. Medium of motion	Sorrow
8. Medium of rest	Desire
9. Medium of Accommodation	Jealousy
10. Medium of Change (time)	Emotion
	Merit, goodness (*dharma*)
	Demerit (*adharma*)
	Sound

However, Pañcānana's[28] categorisation of qualities seems to be better as it maintains only the first five as general qualities and the rest as specific qualities. Here, the merit/demerit are forms of *Adṛṣṭa* and velocity, elasticity and emotions are forms of traits or latencies.

Despite this, the Vaiśeṣika definition of reality *(Dravya)* seems to be incomplete on Jaina count as it does not include the qualities of sense-perceptibility (or otherwise), form, weightlessness, sight etc. in attributes, though they agree to some as separate realities. Nevertheless, they must be given credit to have qualities like elasticity, viscosity which the Jainas do not have. Despite this, Malvania[29] points out that the Jaina definition of reality has been influenced by the Vaiśeṣikas.

Classification of Reality

Jaiṇas postulate poly-realism. They have classified their realities with different angles and they range from one to nine (sometimes upto eleven in canons). From existential point of view, there is only one reality — *Sat,* which could be taken as expression based on universality of reality. This view does not lead to study them properly. The scriptures classify them in two ways — (i) conscious (*jīva*) and (ii) non-conscious (*ajīva*). This is the basic classification. Their inter-relationships have led to further divisions of reality in terms of (i) Categories or *Tattvas* seven in number or (ii) *Padārthas* nine in number and (iii) *Dravyas* formerly five and later six in number. These divisions seem to be relative ones. When the aim is religious, spiritual or ethical one, they vary between 7 to 11 in number. Umāsvāti[30] reduced the canonical number to seven only excluding weal, woe, experiencing and substratum on the assumption of their possible inclusion in other classes (influx and bondage). When the aim is to study the physical world, they are five or six only. Thus, Umāsvāti has gone ahead of canons and Kundakunda[31] in giving a concrete shape to the classification of reality which has been followed by later Jaina scholars. The various divisions of Jaina reality is given in Table 7. It is clear that the living and non-living realities form the base for other realities. Philosophers have discussed the possible origin of these two realities in terms of three stages — concept of elements, concept of livingness originated from specific elemental combination and doctrine of dependant and indepen-

dant souls. Nobody knows who postulated this independant soul doctrine but it has stayed since long and has been able to subdue the non-living elemental doctrine and most probably merge it in itself[32].

Table 7 : Division of Realities by Jainas.

Reality

Ethics based		World-based	
Canonical 9-11	Umāsvāti 7		
Living	Living		
Non-living	Non-living	(i) Living	Non-living
Influx	Influx		
Bondage	Bondage		
Stoppage	Stoppage		
Shredding	Shredding	Non-material	Material
Salvation	Salvation	(ii) Medium of rest	
Experiencing	—	(iii) Medium of Motion	
Substratum	—	(iv) Medium of accomodation	
Weal	—	(v) Medium of change (Time)	
Woe	—	(vi) Mattergy (*Pudgala*)	

One point must be mentioned here with respect to table 7. Though the table indicates the names of ethics based realities in a comparative way, but it is observed that the order of naming them is different in canons and *Tattvārtha-sūtra.* The descriptions of Kundakunda and *Sthānāṅga* are similar where the reality of bondage is at eighth position in both and precedes salvation. *Uttarādhyayana* and *Aupapātika* have the bondage in the third place while Umāsvāti puts it in the fourth place. No commentator has dealt with this difference of order. Possibly the canonical order was influenced by *Bhagavadgītā* advocating human mind as the cause for bondage and salvation. However, the order of Umāsvāti sounds more logical and psychologically convincing[33].

All the realistic philosophies of India are unanimous about two realities — living and non-living under different

names. However, many schools considered quality, action etc. also as realities subject to logical scrutiny by the Jainas[34]. While the Sāṅkhyas would include their realities in their basic classification, others have sub-classified them. This advanced method of classification suggests other philosophies developing later than the Sāṅkhyas. Even if one presumes their development at or near the same period, their different ways of classifications suggest their independent origin. However, it could easily be surmised from Table 8 that the Jainas and Vaiśeṣikas have excelled the others in this regard.

Table 8 : Sub-classification of Reality-*Dravya* in Indian Schools.

School	Number	Names
Vaiśeṣikas	9	Soul, earth, water, fire, air, space, time, direction, mind.
Jainas	6	Soul, Mattergy, space, time, Medium of rest & motion.
Nyāya	12	Soul, Body, Senses, Mind, Matter, Actions, Liberation, other qualities-5
Buddha	(a) 5	*Skandha, Sañjñā, Saṁskāra, Vedanā,* Knowledge.
	(b) 12	Body, Five senses, Mind, Touch, Taste, Colour, Smell, Sound.
	(c) 28	Life, Earth, Water, Fire, Air, Sense-organs, Two sexes, Form, Taste, Smell, Sound, Mind, Seven qualities, Expressions.

Table 8 gives details of sub-classification of reality called *Dravya* (J, V), *Prameya* (N) and *Duḥkha* (B). It is seen that despite varying forms and numbers of this class, any system can easily be explained in terms of Jaina school with some differentiations. For example, one could see that the 12 varieties of *Prameya* in Nyāya could be included in 2 varieties of Jainas (Soul and Mattergy) as qualities and actions are part of mattergy or soul. Similarly 9 varieties of Vaiśeṣikas could be included in four categories of Jainas as below :

1-5	Earth, Water, Fire, Air, Mind	in Mattergy – non-living matter
6-7	Space and direction	in space (non-living non-matter)
8	Time	in Time (non-living non matter)
9	Soul	in living entity

Five, Twelve or Twenty-eight varieties of Buddha school could be included in two (Soul and Mattergy) of the Jaina school. Sāṅkhya's twenty-five could be included in three (Soul Mattegy and Space) of the Jaina school. Thus, table 8 clearly shows that the Jaina classification is the most brief and scientific having minimum number of classes with a maximum of generalisation.

The Jaina classification has one more speciality. It postulates medium of motion and rest as primary reality which no other Indian school has advocated. Though the Vaiśeṣikas have a quality of gravitation in *Dravyas* which is non-material and first cause of falling bodies but that does not compare with Jaina medium of rest as they have presumed it to be temporary as well as permanent, active and associative with earth and water only. The Jainas, on the other hand, assume it to be a universal medium, inert, permanent, neutral and external cause of rest. Thus the qualities of gravitation are just opposite to that of the medium of rest of the Jainas. Also, the Vaiśeṣikas do not have the medium of motion which should be a complementary entity to gravitation. This also confirms more developed classification of reality by the Jainas adding proof to the statement of Sanghavi[35] that the Jaina thought followed Vaiśeṣikas. Ray and Subbarayappa also agree with the ideas of Indian thoughts developing through S. V. and J. schools.

It may not be out of tune here to point out Prof. Jain's[36] statement that the concept of these mediums as realities was unknown even in the realm of scientific thoughts until Newton. He enunciated active force of gravitation or attraction (called Negative ether by Javeri[37]) among earthly and heavenly bodies. The indescribable medium of motion for light through space

called (positive) ether of space was also postulated at the same time. Both of them were assumed material in the beginning but this nature was modified later to be non-material and inert. The development of relativity has cast some doubts on these postulates and the phenomena explained by them are now explained on the basis of 4-dimensional world. This description suggests, had the Jaina concepts been known to the world before Newton, science would have made a high intellectual jump. The above also indicates that the scientists are now moving far off the Jaina thoughts. The progress of knowledge has always been a continuously growing process.

We are concerned here with the world-based divisions of reality by Jainas. Among the different realities, the non-living reality seems to be quite important. It is responsible for the physical phenomena of the world. Table 7 indicates that it has two varieties – material and non-material. The material non-living includes the current matter and various forms of energy and henceforth to be called mattergy while the other class includes the mediums of rest, motion, accommodation and change. This chapter will be limited to the material non-living only as we can directly study about it by many methods today and compare and contrast our current knowledge with the canonical one.

Definition of Non-living Reality or Mattergy

The non-living material reality is most important. It is called *Pudgala*. It is of interest to learn about this reality involving the physical world of mattergy described by the philosophers. The term mattergy has been coined for this reality here, though it does not carry the same meaning as the original Saṁskṛta term. The above mentioned definitions of reality apply to it. It is *sat* or existential. It can be specified by general and specific properties. Grammatically, the Samskṛta term is very sound and consists of two words – *pud* and *gala* connoting the two important qualities of mattergy – association (*pud-*) and dissociation (*gala*)[38]. *Bhagavati*[39] and Umāsvāti[40] describe

mattergy as *'Rūpī'*. The word *'Rūpa'* has six meanings – nature, practice, gross matter, heresay, quality and form[41]. But here it means *'mūrti'* (form) or that having qualities perceptible by senses-specially the eye. Two qualities could easily be perceived by it – colour and shape. Thus, on first count, *'rūpī'* means an entity perceptible to eye. However, a wider meaning has also been given to it. *'Rūpa'* means five qualities – touch, taste, smell, colour and shape. This meaning is more general and utilitarian involving other senses too. Thus, the mattergy is that which undergoes changes in the above five qualities. Kundakunda and Umāsvāti favour this meaning leading to the conclusion that it is not the eye perceptibility which matters for mattergy but it is the sense perceptibility in general. The latter also holds the above qualities to be co-existing. If any one of them is manifest in a mattergy, the others will also be there sometimes in a dormant or indistinct form.

This definition of sense perceptibility of mattergy has been accepted by later Jaina scholars. This seems to be better developed over *Bhagavatī* (receivability by *Jīva,* binding or combining capacity) and *Uttarādhyayana*[42] The literal definition refers to changeability. Thus, in summary, sense perceptibility and changeability through permanence are the characteristics of mattergy. This has all the eight general attributes and twenty-one natures. It is said to be eternal, active, extensive, pervasive in worldly space, formful, infinite and, of course, non-living real. *Bhagavatī* mentions that different bodies, senses, activities, kārmic particles, mind, respiration etc. are all mattergies. *Pañcāstikāya*[43] adds one more adjective to this – all sense-perceptibles are mattergies.

Scientific Definition of Mattergy

The scientists have two different terms for Mattergy (*Pudgala*) of the Jainas – matter and energy. Earlier these terms were separately defined but since Einstein, both the terms have now been merged in scientific world also.

The scientists define matter with three common properties[44] –

(i) It should occupy space or it should have a volume or form.

(ii) It should have a weight.

(iii) It should be subject to our experience or knowledge.

The Jainas counted only (i) and (iii) as common property of matter, though their concept of *Agurulaghutva* – neither-heavy nor-light connotes the idea of weight indirectly.

Jainas have many additional attributes not postulated by scientists. In fact, the scientific definition is not complete and accurate. It fails to illustrate many of the basic properties. Jainas postulate particulate nature, constant motion, insensibility, changeability and other co-existing properties. Hence, the non-inclusion of weight as a common property may be due to the fact that the Jainas assumed energies like light, heat, etc. to be material not seemingly possessing weight.

Recent researches, however, suggest that howsoever small it may be, energies must have weight equivalent to Einstein's equation[45]. Even if we presume Jaina's[46] point of equating electron or other fundamental particles like quarks as the Jainistic atom, they have already been weighed. The scientists are trying to detect particles like neutrons or gravitational energies and they have every hope to prove even these particles to be material. Thus, the weightlessness should be taken as to mean small or negligible weight rather than complete absence of it. The same also applies to the scientific term of energy.

Muniśrī[47] holds that atoms in Jaina scriptures have two varieties – one with four tactile properties and the other with eight tactile qualities. The first one does lack property of weight while the other has it. This only means that the first of these should be energy while the other to be matter of the present.

It could be surmised that inter-coversion of these two types must be occurring in nature specially energy into matter. The current scientists are trying to explain the process. Anyway, whether it is energy or matter, both must have weight, howsoever small it may be and, therefore, of particulate nature sometimes showing dual nature too in the finest states. This is what the Jainas must mean. However, Muniśrī has pointed out that this point of two varieties of atoms by Jainas has a capability of solving many intricate problems arising out of various theories of Universe.

The other common properties of matter not indicated in the scientific definition of matter are very important as they have a clear concept of law of conservation of mass and energy, changeability and the kinetic state of basic unit. The modern world is still unaware of these canonical concepts and books on history of science still have no mention about them. An effort should be made to let these facts be known to the world to evaluate Jaina contribution in the field of scientific concepts.

In the light of the above, it could be suggested that the general definition of matter by scientists must be made more illustrative of its general nature. Undoubtedly, this modification will follow Devasena.

The scientists also agree to many specific properties of matter besides the above general definition. Though the major specific properties could be included in those mentioned by philosophers, still there are many such attributes scientists have added to the list which do not find mention in Jaina canons. They are noted below :

1. *Tactile properties* – Density, hardness, state, melting and boiling points, brittleness.

2. Taste

3. Smell

4. Colour

5. Shape

6. Others – Deliquescence, Effervescence, plasticity, porosity, solubility, surface tension, diffusion, malleability, viscosity, elasticity, etc.

Per chance, many of these scientific properties are based upon experimentation while the philosophical properties are based on natural observation. It is seen that there is deeper specificity shown by the scientists. The deficiency of general definition is, thus, partly made up by them in this way.

Description of General Properties of Mattergy

Most of the general properties pointed out earlier are self explanatory and, per chance, do not require any special description. However, Akalaṅka[48] and Devasena[49] have defined them through their commentaries and aphorisms. The existential property is related with the word *'sat'* having a meaning of generality-cum-particularity (quality and modes). The quality of *Dravyatva* -reality-ness refers to changeability while *Vastutva* refers to functionality of the realities. Visibility should be taken as sense-perceptibility rather than eye-perceptibility only. Livingness refers to the two special qualities of seeing and knowing. Particulate nature and weightlessness refer to the basic atomic nature of the realities.

Special Attributes of Mattergy

It has been pointed out that Jainas agree to six basic specifics of mattergy. All of them are sense-perceptible. The non-livingness is characterised by insensibility towards sense and absence of seeing and knowing. Rest of the five are sub-classified in Table 9 with mention of innumerable varieties of each of them. *Sthānāṅga* mentions that these qualities are known or seen by common man only partially. These properties are co-existing ones. Scientists also agree to them. Thus, the Vaiśeṣika's view of their non-co-existence seems less scientific. For example, they assume air to have only tactile quality while all these qualities can be perceived in its liquified form.

The sub-classification of these qualities is also varied

in different philosophies as shown in Table 10.

Table 9 : Sub-classification of Special Attributes by Jainas.

Attribute	Subclasses	Name
1. Touch (tactile quality)	8	Hot-cold, Light-heavy, hard-soft, Smooth-rough (four pairs)
2. Taste	5	Sour, Sweet, Astringent, Bitter, Acid
3. Smell	2	Good, Bad.
4. Colour	5	Black, Blue, Yellow, Red, White.
5. Shape	(a) 5[50]	Point Space, Long, Circular, Triangular, Tetragonal.
	(b) 7[51]	Long, Short, Point space, circular, trigonal, tetragonal, hexagonal.
	(c) 11[52]	Point space, Circular, Spherical, Triangular, Rectangular, Square, Hexagonal, Upper/Lower part symmetrical, Dwarf, Hunchbacked, Irregular/Unsymmetrical.

Table 10 : Sub-classification of Special Attributes in Some Indian Philosophies.

System	Touch	Taste	Smell	Colour	Shape
1. Vaiśeṣikas[53]	3	6	2	7	4
2. Buddhas[54]	11	6	4/14	4/8	8
3. Jainas	8	5	2	5	11 (5,7)
4. Science[55]	20	4	9	7+2	7, 32

The scientists and philosophers agree that sense-perceptible matter is mutually effected directly or indirectly by the senses. Still, the basis of many canonical descriptions seems to be primarily eye-perceptibility. This is the first step for our learning/knowing process. But as this is based on non-contactile theory, the knowledge gained through eye has been called interior or of gross quality. That is why, many currently incorrect statements have crept in the canons. Some of them may be

mentioned here :

(i) Energies like light etc. are said to be grosser than the gaseous air etc. by Kundakunda in his classification of mattergy (category 3-4) aggregates.

(ii) Sun has been said to be nearer the earth than moon.

(iii) Sound has been said to be grosser than light particles as shown in 23 variforms (groupings – *Vargaṇās, Taijas* (Light), Sound).

(iv) Fine bodied *nigodas* (micro-organisms) have been called grosser than gross bodied *nigodas* in variform classification.

(v) The senses in various types of living beings.

(vi) The enumeration of colours and shapes.

Thus, the knowledge or effects based on partial contactility theory become important. The current scientists and Vaiśeṣikas do not agree on the non-contactility theory regarding eye. They believe a special type of contactility of this sense. It is in this context that Jaina has suggested to define the word A (a, i.e. non-) of Jainas[56] as having a meaning of partial or indirect contactility making the Jaina theory more scientific. The eye perceptibility has been accepted to have a wider meaning of all sense perceptibility as stated earlier. The mattergy has five important aspects as shown in Table 9. These are discussed below.

Tactile Attributes

Tactile attributes are related to touch effects. *Samavāyāṅga*[57] refers to ten touch effects but eight are common. The pair of heavy-light and neither-heavy-nor-light (which is also present in *Sthānāṅga*) has been missing in later canons. It has to be searched when this elimination took place. Does it mean that the concept of weightlessness is a later development ? Table 11 shows that the common eight could be subclassified in four categories —— (a) thermal, hot and cold. (b)

surfacial, hard, soft (c) gravimetric, light, heavy and (d) natural effects, smooth, rough. Jaina[58] has referred the last two as representing crystalline nature. This does not seem to be correct as this should be included in shape or surface effects. In exemplifying the two, goat's milk and sand have been mentioned which also do not lend support to Jaina's view. However, Pūjyapāda[59] has clarified these effects in terms of electrical nature.

Table 11 : Tactile Attributes.

System	Number	Thermal	Gravi.	Natural	Surfacial
1. Vaiśeṣikas	4	hot, cold, a-hot-a-cold	—	—	elasticity
2. Buddhas	11	cold	Light, heavy 4 *bhūtas*	desires (thirst, hunger)	smooth, rough
3. Jainas	8/10	hot, cold	light, heavy (1 pair as above)	smooth rough	hard, soft
4. Science	20	hot, cold	density	—	pain, hard, soft, effervescence, deliquiscence, smooth, rough 10, brittle etc.

It is clear from Table 11 that the Vaiśeṣikas have only thermal and surface effects. Buddhas have pointed out all categories of effects with some difference. The scientists have only three types of touch-effects thermal, gravimetrio and sur-faciai with a large number of additional varieties. In addition, they have also added feeling of pain (as by pricking the needle in the body) as one of the touch effects. They have been able to measure the pain sensitivity[60]. This touch effect does not find mention in canons, though there appears to be some description about it, but it refers more to mental or spiritual

process. However, the table suggests that Jaina touch effects are in advance of the Vaiśeṣikas and Buddhas but they lag behind the current science.

(a) Thermal Effects — The thermal touch effects are agreed by all the systems. However, their number and acouracy varies. The Jainas have two thermal effects. There were no thermometers in philosophical age, hence, the normal healthy human body was taken as standard for relative hotness and coldness. Vaiśeṣikas realised a third variety for those bodies which had the same temperature as the body. The Jainas did not feel for this variety. The Buddhas seem to include hotness in coldness. The scientists, however, express the thermal effects in terms of temperature. By measuring the melting and boiling points etc., they determine the purity of substances. By the concept of temperature, the scientists have given quantitative aspect to the thermal effects. This leads one to feel the comparative refinement by the scientists over the philosophical age.

(b) Surfacial Effects — These effects are also agreed by all systems but their number and definition varies. The Jainas have only two varieties – hard and soft. Though the Vaiśeṣikas have not included them in their touch effects but they agree to hardness in solids and liquidity in liquids. In addition, they have enumerated elasticity as one of the effects which does not find mention in Jaina canons. The Buddhas and the scientists define the surface effects in terms of smoothness and roughness together with hardness and softness. Though the Buddhas have only one each in both types, but the other type of opposite nature could be inferred. On the other hang, the Jainas have explained the smoothness and roughness in terms of internal electrical nature of matter leading to their combination process. Moreover, the scientists have added many more surface effects (more than a dozen) mentioned earlier. All these effects are related to the basic two of the Jainas but they show better insight into the surface effects. Their quan-

titative nature like the scale of hardness etc. makes them still more refined.

(c) Gravimetric Effects — All systems agree to the gravimetric effects in matter except the Vaiśeṣikas. The Jainas have two (four earlier) such effects – lightness and heaviness. Their description of 4-touch and 8-touch matter[61] leads one to believe that the Vaiśeṣika's touch effects are based on atoms. The Jainas too propose atoms to be weightless and therefore surfaceless. But their term of a-light-a-heavy has been explained to mean very small or negligible weight normally called as weightless. The weightless atoms have only thermal and electrical nature, i.e., they are forms of energy. The others have all the four effects with particulate nature. The scientists denote gravimetric effect by density. The word *'ghana'* in canons denotes solidification rather than density. The lightness and heaviness, thus, are due to low or high density. This property seems to be more fundamental rather than gross observation of gravimetric effects.

(d) Natural Effects — The Jainas have mentioned fourth type of effect, the natural effect in terms of electrical nature of bodies. There are two such forms – one opposite of the other termed as *Snigdha* and *Rūkṣa.* This is the property by virtue of which bodies combine with each other. The enumeration of this effect suggests the deeper observation power of Jaina seers. Other philosophies have no mention of these forms though scientists agree to this nature of atoms developed by early twentieth century. But they have three varieties in this regard – positive, negative and zero. The first two terms are equivalent to the Jaina concept. The additional atoms (or matter) of zero electrical nature were recently discovered. Contrary to others, the Buddhas inclusion of desire of thirst and hunger as touch effects does not seem to be logical as they are preferably concerned with taste and smell. Before concluding the tactile qualities, it must be added that there are many more of them known today. They refer to the

physical or mechanical strength of matter. They have become important in modern world as they decide the utility of materials for specific purposes. The scriptures have little mention about them. The Vaiśeṣikas seem to face little better in this regard as they have at least defined viscosity, liquidity, elasticity, velocity and other attributes of differring character though added later to the original 17 qualities.

It is observed, however, that the Jainas have shown sufficient observational capacity in their touch effects in comparision to other philosophies. They pointed out their electrical nature in fifth century[62].

Taste Attributes

Taste is a property perceivable by tongue or sense organ of taste. It is found in bodies having tactile attributes. This is different from the nine literary ones. This could also be taken as different from the six food tastes. Table 12 shows that the Jainas agree to five tastes in comparision to the six by *Buddhas and Vaiśeṣikas*. They have overlooked the salty taste though Haribhadra's commentator[63] has suggested its inclusion in sweet taste. The salt is called sweet in western part of India and it seems that five taste philosophers belonged to this part. In contrast, the scientists agree to only four basic tastes and two complex (astringent and metallic) tastes. They assume that tastes due to corriander etc. are complex sensations and they are not basic tastes. They have included some tastes in their bitter category.

The scriptures have no mention of any mechanism of tasting. The scientists, however, point out that the taste is experienced by nearly 10,000 taste buds in various parts of the tongue. They could also explain why the same substance might seem to have different tastes. It has been found that the tongue is 10-20 thousand times more sensitive towards non-sweet tastes than the sweet ones. They presume that the normal taste sensation is a combined effect of taste and smell

organs. This requires that two sensed living beings might be actually three sensed ones. This has to be investigated properly.

Table 12 : Varieties of Tastes.

System	Number of taste	Names
1. Vaiśeṣikas	6	Sour, Sweet, Bitter, Acidic, Astringent, Salt.
2. Buddhas	6	Sour, Sweet, Bitter, Acidic, Astringent, Salt.
3. Jainas	5	Sour, Sweet, Bitter, Acidic, Astringent.
4. Science[64]	4	Sour, Sweet, Bitter, Salt.

The Jainas have mentioned innumerable varieties of tastes but the scientists have confirmed only about few thousand types. They have also made structure-taste relationship studies and shown that similarly tasting materials have some similarity in their chemical structures. This result is also an advance over the canonical descriptions.

Attribute of Smell

The smell is an attribute percieved by nose or organ of smell. The Jainas and the Vaiśeṣikas have only two types of smells – good and bad. The Buddhas, on the other hand, agree to number of smells varying between three to fourteen as shown in Table 13. This seems to be better and finer. The current scientists go still finer and classify the smells in nine varieties, though arbitrarily. They have pointed out that smell sensation is much more acute than taste and have described it as a taste at a distance. They have also been able to measure the intensity of smells by olfactory co-efficients. Structure-odor relationships have also been observed in many cases. Though their classification is arbitrary, but it has a more general base. It is suggested that the smell sensation is also a combined effect. These facts suggest that philosophic classification of smells represents only the common-sense view and the new

age has gone much deeper into the science of smells and tastes.

Table 13 : Varieties of Smells.

System	Number	Names
1. Vaiśeṣikas	2	Good, bad
2. Jainas	2	Good, bad
3. Buddhas[65]	(a) 3	Good, bad, a-good-a-bad
	(b) 4	Homogenous (good, bad) Heterogenous (good, bad)
	(c) 14	As in *Dharmaskandha*
4. Science	9	Ethereal, Resinous, Ambrosial, Garlic, Burning, Goat, Repulsing, Nauseating, Balsamic.

Attributes of Colour

The colour is an inherent attribute percievable by the sense of sight – the eye. It may be natural, pigmentary or spectral. All have eye perceptibility. The number of colours agreed by Jainas is five. Their order, however, varies from Pūjyapāda[66] (black, blue, yellow, white and red) to Akalaṅka[67] (blue, yellow, white, black and red) the former being more scientific. Table 14 indicates that all realistic philosophies agree to four colours – blue, yellow, red and white, while they differ in other colours. The Vaiśeṣikas agree to green, brown and a variegated one (*citra*) in addition while the Jainas have a black one. The Buddhas have primarily four colours, the Vaiśeṣikas have seven in contrast to the Jaina's five. The Buddhas have an additional variety of nine colours as shown in Table 14. This represents the colours of the various objects like clouds (whitish), smoke (blackish white), sand (yellowish white) and sky (bluish). However, this does not add to the basic four. The assumption of black colour by the Jainas may be due to the fact that owls and cats can see things even in the dark. The dark photography has confirmed this. It could be surmised that the philosophers felt the other colours as mixed rather than primary.

Table 14 : Varieties of Colours.

System	Number	Name
1. Vaiśeṣikas	7	Blue, Yellow, Red, White, Green, Brown, Variegated.
2. Buddhas	(a) 4	Blue, Yellow, Red, White.
	(b) 9	Clouds, Smoke, Sand, Vapour, Light (sun, moon), Shadow, Darkness, Sky.
3. Jainas	5	Blue, Yellow, Red, White, Black.
4. Science	7+2	Ultraviolet, Violet, Indigo, Blue, Green, Yellow, Orange, Red, Infra-red.

Muniśrī and Jaina[68] have referred Optical Society, 1922 to define colour as sensation produced through light and eye from the activity of retina and its attached nervous mechanisms. It is an objective natural property depending upon structural specificities. Accordingly, the colour has two types – (i) perceived by the eye and (ii) objective. If there is no sense of sight, how the colour could be perceived ? Thus, the objectiveness of the colour becomes important. Each object must have its own colour visible to our eye. Many scientists and philosophers, however, agree to colour as only to be subjective. In contrast, Muniśrī[68] has described two factors responsible for colour sensation – (i) subject and (ii) object. If 'a' is the objective property, b_I, b_{II} etc. are subjective properties and k_I, k_{II} are perceived colours, the colour sensation will be similar to all subjects, their senses being normal, or

If $b_I = b_{II}$, $k_I = k_{II}$ or

$a + b_I = a + b_{II} = k_I = k_{II} = k$

This suggests that for normal colour sensation, the two factors must be normal and undistorted. If the factors are faulty, the sensations may also be similar. Thus, the nature of the object is also important for colour sensation. The supra-sensuals have a different case, however.

The scientists presume that different bodies do absorb light and emit it in part depending upon their structure. The colour of the body is not due to its absorbed light but it is dependent on the nature of light emitted by it. Each colour has a range of wavelength of its light. It could be represented by spectrum. All visible colours fall in the wavelength range of 4000-7000Å which is known as visible range. The wave- length lesser than the violet is known as ultra-violet and the range larger than red colour is known as infra-red. Both these ranges are human invisible ones. These may be called dark or black in general. Thus, the black colour of Jainas may denote the ultra-violet and infra-red regions of invisible light. Jaina[70] has called this range as empirical colour.

For convenience, the scientists have classified colours in seven broad classes known as VIBGYOR (Violet, Indigo, Blue, Green, Yellow, Orange, Red). It is seen that when a substance is heated, it emits black infra-red light in first instant followed by red, yellow and finally white light on further heating. At higher temperature, blue hot light may be emitted. That is why many stars are bluish white. Thus, one may have different colour in cold and hot conditions.

The white light of the sun was studied by Newton who proved it to be consisting of the above seven colours. Out of these, the Jainas do not agree to violet, green, orange and indigo, though these colours are specific and have their spectrum range. But it seems that Jainas assume them to be mixed colours as observed in painter and printer's colours. However, splitting of white light and rainbow suggest the existence of seven spectral colours. How the Jaina scholars with keen observation powers missed these colours, is a matter of surprise. Still, while inclusion of black colour is a distinction for the Jainas, the exclusion of other spectral colours shows some overlooking in their observations. Their concept of white colour as a basic one also requires re-examination. Jain[71] has called it also not a normal but a formal colour.

Prof. Jain[72] has classified the colours as pigmentary, natural and spectral. He has suggested that the philosopher's colours are the natural ones. Does it mean that rainbow colours are not natural ? He has differentiated between pigmentary and spectral colours. However, this does not make any difference in their number and spectrum ranges. Whatever be the colour, it will be perceived by its spectral characteristics. It is on this basis that pigmantary colours are said to be of mixed spectrum and saturated one. Moreover, his comments in support of the number of canonical colours requires reconsideration. Jain[73] has suggested a way out. He points out – there are two types of colours – atomic and molecular. The Jaina colours represent the atomic colours which are basic three – red, yellow and blue. The rest two being called formal rather than basic ones. This logic may be applicable to all the qualitative discussions and per chance this may solve some of the problems and increase scientificity in Jaina concepts.

The spectrum range of the colours (blue-red) of the Jainas and other Indian philosophers represents that of only five colours of the scientists. The philosophers have accepted only three of them (blue, yellow, red). This should not be taken as a large defect looking to the pre-instrumental age observations. Their range does not include ultra-violet, violet and indigo *colours. On this basis and by the composition of white colour, scientist's observations seem to be finer and more accurately* additive to the canonical ones. The canonical infinite variety of each colour, however, is substantiated by the spectroscopists as each of the seven colours represents a range of spectrum rather than a specific one.

Attribute of Shape

While defining mattergy, the word *'rūpa'* or 'form' was coined. The form is denoted by shape. It is also a property perceivable by the eye. This is property of extension in space in two or three dimensions. Some Buddhas presume[74] form and colour as inseparable as one cannot exist without the

other. Thus, the property of colour is also associated with shape. While the Vaiśeṣikas mention only four or five types of shapes, the Jainas have upto eleven types with the Buddhas having eight types as shown in Table 15.

Table 15 : Varieties of Shapes.

System	Number	Names
1. Vaiśeṣikas	4+1	Space point, Trigonal, Spherical, Tetragonal, Flat.
2. Buddhas	8	Space point, Long, Short, Circular, Symmetrical, Non-symmetrical, Raised, Flattened.
3. Jainas	5	Space point, Long, Circular, Trigonal, Tetragonal.
	7	Space point, Long, Short, Circular, Trigonal, Tetragonal, Hexagonal.
	11	Space point, Circular, Triangular, Rectangular, Symmetrical, Lower part symmetrical, Upper part symmetrical, Dwarf, Hunchbacked, Irregular, Hexagonal.
4. Science	7	Cubic, Monoclinic, Triclinic, Trigonal, Pyramidal, Prismic, Hexagonal.

Geometrically, they include two or three dimensional units. The number of shapes by Jainas was five in the beginning which has developed upto eleven through six and seven. It is clear that this number is an advance over the other systems. However, the current scientists[75] agree to only seven types of basic geometrical shapes – almost all with three dimensions. They do not include irregular shape as one of their varieties – it being taken as a mixed and undefined one. They also do not include dwarfs, hunchbacked etc. as their nature is not basic. The shapes by scientist contain the property of symmetry and a-symmetry. They have sub-classified them into 32 sub-classes too complex to be detailed here. However, the

Jainas must be given credit for observing symmetry in shapes and mentioning diamond of a hexagonal shape as agreed today[76].

The Jaina scriptures do not mention the specification of various shapes. On the other hand, the crystallographers can tell their internal structures with their unit cell dimensions. Not only this, they have learnt the condition under which a body can be given different shapes. The Jainas seem to have observed the gross crystalline substances. The scientists can now tell that a gross body is made up of a group of single crystals or unit cells useful for modern electronic equipments.

The property of shape has been included in the term *'rūpī'* in *Bhagavatī* and by Pūjyapāda and others. But it seems that the original literature mentions it separately as in aphorism 5. 24 of Umāsvāti by the word *'Sansthāna'* and in *Uttarādhyayana.* It could be due to its gross nature in comparision to other qualities. However, the aphorism also mentions other forms of matter which are finer than basic shapes (i.e. shadow, darkness, hot and cold light) which are either forms of light or its phenomena and perceptible by eye. *Uttarādhyayana*[77] seems to be right by keeping light and sound in one category and shape in another category of matter manifestations. This raises the following points for serious considerations :

(i) The period by which sound has been taken to be grosser than light.

(ii) Umāsvāti has mentioned 15 modifications of matter in his aphorisms 5. 23-24 while *Uttarādhyayana* mentions 16 of them by excluding some of Umāsvāti's contentions (fine, gross, binding, dissociation, motion) and including some additions (oneness, separateness, combination, division, number, lustre). This difference in number and types of manifestations also requires elucidation. It could be mentioned that Umāsvāti's binding and dissociation are equivalent to combination and division of *Uttarādhyayana.* Further, Rampuria[78] seems to have condensed these manifestations to keep the number fixed.

These include motion, fine-grossness and a-light-a-heavy forms too. Still, the difference remains to be considered.

There seems nothing to learn when shape as a basic property was eliminated but most Digambara scriptures do not mention it in that way. Besides grossness, it is also clear that the property of shape refers to solids only, liquids and gases have no definite shapes. This could be an additional reason for its elimination from basic qualities later.

Besides the above, one more related point requires evaluation. Akalaṅka maintains that touch, taste and smell are finer than colour (and shape too) due to their non-perceptibility by the eye[79]. The concept of eye-perceptible objects being always grosser does not seem to be correct. This is the only sense which defines and determines the order of fineness. The optical instruments have increased the capacity of eye enormously. Actually, the fine properties of an atom by the Jainas prove the equivalence of the four qualities. But it seems that the commentators have led to some controversy in this regard. This could have been avoided if Umāsvāti's aphorism 5. 23 would not have been there, though Bhāskaranandī[80] has explained its utility in pointing out their co-existence.

It must be pointed out that touch is a sensation due to shape, size, etc. It is due to gross material bodies themselves. In contrast, taste and smell are due to some specific chemical substances in matter which are molecules whose normal sizes could be measured in Angstrom units. These molecules are definitely grosser than light particles. In view of this, the canonical position leads us to some very unpalatable conclusions that (a) eye perceptible objects are grosser.

(ii) This assumption also leads one to presume that our knowledge about matter is mainly grosser one, though there is quite a good amount of fineness in many cases due to intellectual analysis of visual observations.

Attribute of Motion

Motion is a common attribute for matter and energy.

Akalaṅka[81] describes ten types of motions in them. These are projectile, uncoiling, wave, collision, immersion, gravitational, brownian, combinational, natural (air, fire etc.) and motion due to lightness. These are only translational motions. However, *Bhagavatī*[82] mentions, vibratory, penetration and transformatory motion also besides colliding and translatory one. The two terms – *parispanda* and *pariṇāma* – normally refer to static and dynamic motions, translatory and transformatory motions. These various types of motions are indicative of a very good order of observational power of Jainas over the Vaiśeṣikas who have only five types of actions like throwing upwards, downwards, contraction, expansion and movement. Moreover, what the Jainas have called a natural motion, they have assumed it to be a super-powered motion[83]. Current science also agrees to almost all types of these motions. However, they have two additional motions – rotatory and spin. These motions are playing good part in the development of our physical comforts. The Jainas presume that even the fine atoms have motions of various types.

Umāsvāti[84] has mentioned 39 types of activities causing influx of *kārmic* matter. These are more of mental character rather than physical and are not related to our discussion here.

Modifications of Specific Attributes : Consecutive Properties

All the attributes described above undergo modifications. These are called *paryāyas* or modes. They are not co-existents like the general attributes. For example, colour will always be there in matter, but the specificity of colour is always changeable. The specificity of colour could be called a mode or the process of modification. These are temporary in contrast to general attributes. Mattergy is, thus, always associated with some permanent attributes and temporary modifications. It is these latter which are called consecutive properties. These are manifested in many ways. Grossness, fineness, shape, associated and dissociated forms and motion are found in matter while heat, light, sound, shadow, darkness and motion are

associated with energies. The details of these modifications are given in post-canonical literature. The modifications due to energies will be described in Physics section and the material modifications are summarised here. As already pointed out, about a total of 14-16 manifestations are described in canons.

The fineness and grossness represent the size and quantity of matter. Each of the two has two varieties – absolute (in atom) and relative (in universe). These represent the lower and upper limit of length and number. Shapes and motions have already been described.

Dissociation or division (*bheda*) may have six varieties – (i) sawing (wood), grinding (wheat), breaking (into pieces), threshing, layering and hammering. All these represent only the physical processes involved. They also give us an indirect idea of different types of mechanical strength in matter. Chemical or electrical methods of division or dissociation are not mentioned in canons.

Association or bond or union has been classified in different ways. It may be classified as partial or total. The partial bonding may be equated to physical bonding, temporary and unquantitative. The total bonding may be equivalent to current chemical bond. Both these bonds may be natural or experimentally/externally caused. They may be due to mixed causes too. The natural has two varieties – with beginning (rainbow, lighting, meteoric phenomena etc.) and without beginning (bond between non-material realities). The first one has both the varieties of current bonds-physical (rainbow) and chemical (lightning). The second one has no equivalent term in current science. Akalaṅka[86] mentions its nine classes.

The experimental/external union has also two varieties – union between non-living materials and union between non-living and living entities (which may be *kārmic* and quasi-*kārmic*). The material bond consists of five varieties and seems to be mostly physical. The classification of bonding has been summarised in Table 16.

Table 16 : Bonding in Matter.

- Bonding or Union
  - Natural
    - (i) With beginning (fire, rainbow etc.)
    - (ii) Without beginning (bonding in non-material bodies : 9 types : Soul, Space-points, many souls, largest aggregates
  - Experimental
    - Union between material objects
      - Union of bodies 15 types
      - Fastening
      - Painting
      - Adhesion
      - Ligamentation (embodied) 2 types with or without beginning
    - Union between material and living objects
      - (i) Kārmic bond
      - (ii) Quasi-kārmic

The details of union of bodies and embodied are given by Akalaṅka[87]. However, his classification differs from *Bhagavatī*[88] which maintains that experimental bonding has three varieties – without beginning and end, with beginning and without end and with beginning and end. The last variety has four sub-classes instead of Akalaṅkas five. The second sub-class known as *Alīna* has four varieties including painting and adhesion. It also includes jointing and heightening. The jointing may be partial or total. Also, the *Śarīrī* (embodied) bond is termed as *śarīra-prayoga* or body-using bond. Some details are also different in *Bhagavatī*. However, it seems Akalaṅka has simplified the classification.

The atomic bonding does not seem to be included in the above but they could be included in the variety of material bondings. Though they have both types of bonding processes. Their bonding may be partial or total and subject to certain rules described in later section. The other four varieties of bond-

ings seem to be physical only. They lead to physical changes only. However, it has been stated that gross bodies or molecular aggregates are formed due to them. These are always in the form of aggregates in contrast to touch etc. which may be atomic also.

All modifications in matter taking place due to the above processes occur in two ways – distinctly and indistinctly. The latter are fine and comparatively momentary while distinct ones are clearly discernible and somewhat more durable. The above modifications of Umāsvāti or *Uttarādhyayana* belong to this class. They are caused internally or externally. The change of colour, formation of molecules, formation of curd from milk and the like are modifications due to internal causes. They are quite common even in our daily life. In some cases, cause of change has also been mentioned in literature. New age has not only identified the causes, but it has utilised them in many more fields. It must, however, be added that there are very few changes mentioned in canons which are of chemical nature.

Function of Mattergy

Canons and Umāsvāti[89] mention some of the functions of matter. It is said that they form the basis of bodies of living beings or six types of embodiments, the sense organs of speech, mind and respirations. They also cause and contribute to the feelings of pleasure, pain and livingness. Death is another phenomena which is also effected by matter through stopping respiration etc. These are normal observations and verifiable ones.

Classification of Mattergy

Bhagavatī mentions that reality could be described with respect to five angles – substance, place, time, mode and characteristics[90]. It is infinite with respect to all these angles. The scholars felt the necessity of classifying this infinite variety for proper studies. This has been classified in many ways. These classifications are based on many aspects like basic

nature, sense perceptibility, forms, formations, grouping, parts and grossness-fineness. Accordingly, it has been said to be of one, two, three, four, six, twenty three and five hundred and thirty types. They are described below in short. It may be added that only some classifications are tuned to recent methods.

One and Two Varieties of Mattergy

Basically, it is assumed that all mattergy is made up of atoms. Hence, structurally, all types of bodies are ultimately atomic in nature, i.e., of one type only. However, the literature classifies mattergy in two types – one by sense perceptibility including tactile qualities, particulate nature, spatial property and soul-binding capacity and the other by composition and constituents. On the first basis, the matter may be gross and fine. The gross one has touch, particulateness and space occupancy. The fine variety is normally sense-imperceptible despite having all the characteristics of matter. Compositionally, the two varieties of mattergy are designated as – (i) atomic (*aṇu*) and (ii) atomic aggregate (*skandha*). The first is ultra-fine and the second type could be fine and gross, visible and invisible. They will be described in next chapters. The Vaiśeṣikas and Buddhists also agree to the fine and gross variety of mattergy in their own specific terms.

There are many other ways also in which two types of matter has been mentioned in canons[91]. They are as below :

(i) Receivable and non-receivable by soul substance (*kārmic*/quasi-*kārmic*).

(ii) Different and non-different.

(iii) Fragile and non-fragile.

(iv) Bonded and touched and non-bonded-non-touched or (a) Receivable by sense-organs of touch, taste and smell and (b) Receivable by sense of hearing.

(v) Desirable and undesirable.

(vi) Pleasant and unpleasant or liking and non-liking.

(vii) Mentally pleasant and unpleasant.

(viii) Divided and undivided.

(ix) Associated with or without consciousness.

(x) Good and bad.

Some of these classes represent specific properties of matter and others seem to be literary classes only. The compositional and perceptibility based classification is most important.

Three Classes of Mattergy

Bhagavatī[92] has classified Mattergy in three varieties depending on the types of changes it undergoes. Some have capacity to change naturally without any effort from human beings. There are twenty-three phenomena cited under this heading which include lightning in sky, fog and hail-storms, rainbow, rains, meteoric falls, storms and hurricanes etc. These could have five main and twenty sub-classes and 530 total classes as per *Prajñāpanā* 1.1[93], with respect to changes in touch, taste, colour, smell and shape. Some mattergies have capacity to change or modify themselves through external or experimental causes and human beings play a role in it. That is why they have five varieities represented by 1-5 sensed beings. The divisions of these beings make the varieties quite enormous. Some changes take place by mixed process of natural and efforts of living beings. This variety has been classified similar to the second category. No examples are given in this case.

The changes and modifications take place in atoms and their aggregates. The methods of change mentioned here seem to be very general and one could guess their preliminary nature in today's comparison.

Four Classes of Mattergy

Bhagavatī[94] and Kundakunda[95] have classified mattergy in four types :

(i) Aggregation (*skandha*),

(ii) Half of the aggregation (*skandha-deśa*),

(iii) Half of the second category (*skandha-pradeśa,* of *skandha*) and

(iv) Atom (*paramāṇu*).

This classification seems to be an extension of the two compositional varieties as above. These varieties have been equated to molecules, atoms or ions, nuclear particles and electrons by Jain[96] which does not sound logical in view of Javeri's opinion which is realistic. This matter will be referred later.

Six Classes of Mattergy

Pañcāstikāya and *Niyamasāra*[97] of Kundakunda mention six types of aggregatal mattergy on the basis of their perceptibility by the eye and senses other than eye. In other words, this is a classification of *Skandhas* (aggregations) based on grossness and fineness. They will be described in appropriate chapter. However, it must be pointed out that there is some doubt about these classes. Whether they represent aggregations or matter in general. However, Kundakunda mentions the classes for aggregations only. Jain[98] has called this classification as most scientific and uptodate as it includes all types of solids, liquids, gases, energies and subtle matter.

Twenty-three Types of Mattergy

The *Ṣaṭkhaṇḍāgama* book 14[99] and *Gommaṭasāra* (J) describe another classification based on compositional similarities. It is known as variform or *Varganā* classification. These variforms or groupings occur in aggregations according to Puṣpadanta Bhūtabali. Thus this classification also refers to aggregations. *Gommaṭasāra*[100] seems to confuse this point by mentioning the six-fold (as above) and this classification as belonging to mattergy in general. This also seems to be an extension of earlier classification. The word *Vargaṇā* means aggregation, atomic grouping or molecules. This is found in sense perceptible and imperceptible bodies. The twenty-three types of groupings start from the finest (mono-point atom) and end at the grossest. This has fine atomic aggregate in the first place and the universe as a whole in the last place. In

between, there are many variforms shown in table 17. It could be seen on the first count that atoms should not be included in this grouping as it is not an aggregate, though it has capacity for aggregation. Secondly, it could be taken as an effect atom or phenomenal atom. Any atomic aggregation could be included in grouping 2, 3 and 4. The first four groupings are said to be non-receivable by the living ones.

Table 17 : Variform (*Vargaṇā*) classification.

Canonical	Suggested modified form
1. Atomic aggregate	Real atom
2. Numerable atomic aggregate	Numerable atomic aggregate
3. Innumerable atomic aggregates	Innumerable atomic aggregates
4. Infinite atomic aggregates	Infinite atomic aggregates
5. Intakeable aggregates (3 bodies)	Kārmic aggregates
6. Non-receivable intake aggregates	Non-receivable intake aggregates
7. Fire, light, electricity, *Taijas* or caloric aggregates	Receivable intake aggregates
8. Non-receivable *Taijas* (caloric) aggregates	Non-receivable *Taijas* (caloric) aggregates
9. Sound or speech aggregates	Receivable *Taijas* aggregates
10. Non-receivable sound aggregate	Non-recievable sound aggregate
11. Physical mind aggregate	Receivable sound aggregate
12. Non-receivable mind aggregate	Non-receivable mind aggregate
13. Kārmic aggregates	Receivable mind aggregate
14. Fixed or un-differentiated aggregates	Fixed in differential aggregate
15. Continuous differential aggregates	Fixed aggregates

16.	Continuous differential zero aggregate	Continuous differential zero aggregate
17.	Individual body aggregate	Continuous differential aggregates
18.	Fixed indifferent (zero) aggregates	Individual body aggregate
19.	Gross common-body (*Nigoda*) aggregate	Gross common body aggregate (zero)
20.	Gross common body zero aggregate	Gross common body aggregate
21.	Fine common body aggregate	Fine common body aggre-aggregate
22.	Sky aggregate	Sky aggregate
23.	Largest aggregate	Largest aggregate

On the basis of the first smallest and last largest variform it is natural to assume this classification to be based on increasing grossness. There seem to be following discrepancies in this assumption :

(i) Light particles are shown to be smaller than sound particles while both are energies. This is against Kundakunda classification who has placed them in different classes.

(ii) Kārmic aggregates are placed below sound whereas Kundakunda has taken them in his fifth category of increasing fineness. He has placed sound in fourth category.

(iii) The fine common body variform has been placed below the gross common body which is against the common experience.

(iv) The fine unreceivable variforms (6,8,10,12) have been placed below the receivable gross ones.

(v) The corresponding indifferent or zero groupings (16, 18, 20) have been placed below their normal variform.

(vi) The position of 18th grouping-fixed indifferent is incongruous.

These discrepancies require clarification to make this

classification a little more scientific. This might involve the following points :

(i) Real or phenomenal atom should be substituted in place of atom in the first position.

(ii) Placement of kārmic aggregate should be done below atomic aggregate or fourth variform.

(iii) Placement of all unrecievable variforms above their corresponding normal variforms.

(iv) The position of 18th variform should be corrected and placed below the 14th variforms.

These points require a modified variform classification which has also been suggested in Table 17. However, it must be pointed out that there will be no incompleteness if the suggested variform numbers 5, 6, 8, 10, 12, 14, 16 and 19 are eliminated and the total mumber of variforms is limited to fifteen.

It is said that the intake variform involves the first three-gross, transformable and ejectable-bodies. Similarly, it has also been pointed out that the variforms of intake, caloric, speech, mind and kārmic are bondable with the living, as they contain infinite atoms in their groupings. These are also known as receivable by the living units. The receivable variforms are defined as those containing one atom more than those contained by the non-receivable groups. Larger the number of more atoms, greater will be the receivability. It is stated that there are eight receivable groupings – gross body, transformable body, ejectable body, luminous or caloric body, kārmic body, speech, respiration and mind – according to *Karmagrantha*-V. These are important for the spiritual upliftment.

Five Hundred Thirty Classes of Mattergy

Vanthia refers *Paṇṇavaṇā Sutta* to mention five hundred thirty varieties of mattergy depending upon its primary and secondary nature of five basic qualities and their subdivisions. As stated before, touch has 8 types, taste 5, smell

2, colour 5 and shape has 5 types. Accordingly, we have the following countings :

(i) With colour as primary and others as secondary, the varieties are, 5 (8 + 5 + 2 + 5) = 100 types.

(ii) With touch as primary, we have 8 (5 + 5 + 2 + 5 + 6) = 184 types.

(iii) With taste as primary, we have 5 (8 + 5 + 2 + 5) = 100 types.

(iv) With smell as primary, we have 2 (8 + 5 + 5 + 5) = 46 types.

(v) With shape as primary, we have 5 (8 + 5 + 2 + 5) = 100 types.

Total Types = 530 types

This classification seems to be meant for classification only. It is quite vague and may be overlooked for fundamental discussion. It only indicates that a mattergy can assume a variety of types on the basis of predominance of its properties.

Infinite Types of Mattergy

The last classification assumes mattergy to be of infinite variety with respect to class and intensity of its various attributes. Actually, this is no classification but a statement indicating complex nature of matter made up of atoms and its aggregates of various types. The qualities and modes enter into picture to make up infinity.

It may be said here that all the above classifications of mattergy date back from pre-Christian era to about 200 A. D. and most of them are extensions of the two basic varieties. Some discrepancies in various classifications are observed and they need examination and rectification.

The Vaiśeṣikas and Buddhists have not much to offer in this regard. Their four basic elements of earth, water, fire and air are atomic or combined atomic. Their atoms combine to form diads, triads, etc. with no special names for these

species called *skandhas* by the Jainas.

Modern science has classified mattergy in two forms : atoms and their combinations or molecules akin to Jaina's basic two. However, the Jainas presume all the atoms (per chance ideal) as similar contrary to 109 varieties of scientists. Their atoms should be equated to real atoms of the Jainas. The aggregating of atoms may be classified in many ways specially chemically and structurally. The structure of atoms and molecules is within current scientific knowledge. The Jainas could not go deeper into the atoms and molecules because of their all-time truth authority. However, the various classifications of philosophers suggest their base to be sense-perceptibility and common sense. The scientists classification, on the other hand, is based on more fundamentally structural and instrumental basis.

Conclusion

The above comparative description of the definition, properties and classification of mattergy suggests that the philosophical contents of the Jainas stand in a contemporarily high position where concepts and intellectual maturity is concerned. Their observation power has been enormous. However, when one compares the canonical contents with the current knowledge, one feels the difference. But here the fortunate position is that most of new additions to the knowledge are supplementary rather than contradictory. Though there are many discrepancies in many descriptions but they could be rectified or rearranged easily in view of the current knowledge. One has to feel, however, the keen and acute observation power and analytical capacity of the Jainas. The above descriptions about mattergy point out about the gap between the level of knowledge during the scriptural age and our age. It could be confidently said that had there been instruments like today, little less aversion to physical labour for experimentation and proper communication, the seers of the past would have stood the current times.

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Chapter 6

Jaina Theory of Skandhas or Aggregations

Skandhas : Definition of a Specific Term

Primarily, the postulate of two classes of mattergy — *aṇu, paramāṇu-pudgala* (atoms) and *skandha* (aggregations) based on basic conceptual structure of matter is most important among the various classifications. The various atomic aggregations of the current times are now equated to *skandhas.* They are comparatively gross and perceivable. They could, therefore, be studied and described in an intelligible way. They are treated first in preference to finest *anus* or atoms. They are like trunk of a tree supporting the material universe.

The term *Skandha* is a typical and specific in Jaina philosophy representing a unit of mattergy different from atoms but composed of them. The scriptures define the term quite clearly with the following points :

(i) Aggregations are aggregates or combinations of atoms[1]. They are non-natural modifications dependant on other objects[2].

(ii) They are gross and fine in forms. Some of them are visible to the eye while other may not be so.

(iii) The atoms in the mattergy are in a state of motion caused internally or externally[3].

(iv) They can be taken by hand, received or bonded with others and handled as desired[4].

(v) There are smaller entities too like those formed from aggregation of two atoms. They may not be satisfying (iv) above, still by interpolation, they are also called aggregates, of course fine ones[5].

(vi) There are infinite number of aggregates of different

forms and manifestations like sound, bonding, division, grossness, fineness, shape, darkness, shadow, sunshine, moonlight, motion and touch, taste, smell and colour etc.[6] They have varied qualities.

(vii) These aggregates are produced by association, dissociation and a mixed process. The sense perceptible ones are produced by the mixed process.[7]

(viii) The aggregates are supposed to be embodying all characteristics of the piece of matter to which they belong.

(ix) They are active and may be transformed or modified in various ways.

(x) The aggregation may be caused and effected due to atoms. They may also become cause for higher aggregational effects.[8]

The Buddhists have one word for matter – rupa consisting of two varieties – primary elements or *mahābhūtas* and secondary elements or *utpādarūpa.* Both of them are called *rūpa-skandhas* consisting of atoms or aggregates. However, the Buddhist atoms, combined atoms or primary elements are all equivalent to *skandhas* of the Jainas as they are made up of 7-10 small constituents. Thus, for them, matter is nearly aggregational or molecular. The *utpādarūpas* have been descri-bed to be 15, 16 or 24 in number – all aggregational species.[9]

The Vaiśeṣikas postulate atomic theory but they do not have a separate or common term for atomic aggregations. They are called effects by them, their nomenclature is depending on the number of atoms participating in aggregation like dyads, triads etc. These may be called large or composite mattergy forms[10]. The composite-constituent concept of inferential nature in this connection has been discussed by Prabhacandra.[11]

Current scientists have the term-mixtures, molecules and compounds for various atomic aggregations. However, the molecules and compounds are chemically bonded in contrast

to many physically bonded atomic aggregates. The Jaina term *skandha* includes, however, both types of bonding – physical and chemical as well. The current examples may be mixture of inert gases in air, molecules of hydrogen or oxygen elements or water as compound. The *skandhas* or aggregates, thus, include all types of aggregation of elements, molecules, compounds or mixtures. This Jaina term is, therefore, more general than the term molecule of the scientists. These molecules, however, have the capacity to get dissociated into their constituents.

Classification of Skandhas or Aggregations

Bhagavatī[12] and *Sthānāṅga*[13] classify aggregations on the basis of number of atoms (or space points they occupy) contained in the aggregates. That is why, they are said to be infinite with respect to the number of atoms and their arrangement or properties. They have given the aggregation varieties or sub-classes of four properties upto infinite-atomic gross aggregations as shown in Table 1. These seem to be more intellectual rather than real. There is large amount of degree of variations in properties and hence *Sthānāṅga* mentions infinite varieties of all types of atomic aggregations.

The post-canonical scholars, however, felt the need to realistically classify them for proper studies. They have been classified in many ways. The first classification consists of their two varieties-gross and fine[15], sense-perceptible or otherwise. The fine mattergy like diatomics, kārmic matter, 4-8 touch mattergies, finely transformed infinite atomic aggregations come under the first category. The rest are under the second category. This classification is based on common-sense view. The other classifications are also based on matter as such and summarised in Table 2. They are not illustrated except in the fourth one, where the criteria of eye perceptibility has produced a discrepancy in current terms pointed out by this author[16] and Jain[17].

Table 1 : Types of Atomic Aggregates (*Bhagavatī*)[14].

Aggregate type	Touch	Taste	Smell	Colour	Total
1. Diatomic	9	15	3	15	42
2. Triatomic	25	45	5	45	120
3. Tetratomic	36	90	6	90	222
4. Pentatomic	36	141	6	141	324
5. Hexatomic	36	186	6	186	414
6. Septatomic	36	216	6	216	474
7. Octatomic	36	231	6	231	504
8. Nonatomic	36	236	6	236	514
9. Decatomic	36	237	6	237	516
10. Infinite atomic-fine	398	237	6	237	878
11. Infinite atomic-gross	1296	237	6	237	1786

Table 2 : Various Classifications of Aggregates or *Skandhas*.

No.	Classes	Names
1.	2	Gross and fine, small and large
2.	3	*Skandha, Skandha-deśa, Skandha-pradeśa*
3.	3	Transformable by internal, external & mixed cause.
4.	6	Gross-gross, gross, gross-fine, fine-gross, fine, fine-fine.
5.	23[21]	Twenty three variforms (detailed earlier).
6.	530[22]	With reference to five qualities as primary and secondary (detailed earlier).

The second classification is based on structure of mattergy in general (which is of four types) where three out of four varieties should be aggregates[18]. Accordingly, the canonical atomic sizes should be less than one-fourth the size of an aggregate at the minimum level. Here one is unable to guess the meaning of an aggregate whether it is diatomic or polyatomic. If it is diatomic as a minimum, the *skandhadeśa* will

be atomic and the *skandhapradeśa* will be sub-atomic. In other words, the canonical atom should be divisible which seems undesirable. This suggests that Jain's[19] illustrative equations of these terms are not correct. Javeri, on the other hand, takes a real view of defining *Skandha* with grosser bodies and the other terms being its conceptual divisions and *skandhas* by themselves[20]. The *skandha-pradeśa* in this way will mean a single molecule of an element or compound consisting of number of atoms possessing the property of *skandha* itself. The classifications 3, 5, 6 are described in the earlier chapter. They seem to be more philosophical than scientific. The fourth classification requires some exploration.

This classification seems to be moving from gross to fine on the basis of eye-perceptibility criteria and it has been exemplified by solids, liquids, energies, gases, kārmic matter and finer diatomic aggregates. Because of eye perceptibility criteria, categories 3 and 4 in Table 3 have become discrepant as energies are finer than gases. This is also clear from classification 5 where *taijasa* (energies) has been shown earlier than sound, mind and kārmic matter. Despite this, Jain[23] has called this classification as most scientific and uptodate as it includes all types of solids, liquids, gases, energies and subtle matter.

There is one more point regarding the illustrative meaning of the sixth category of fine-fine class. Kundakunda illustrates it with finer particles than kārmic aggregates[24]. Javeri supports it by saying that kārmic particles are made up of innumerable number of ideal atoms. He means that even this type of aggregate will be finer than the fifth category. This may include dyads, triads etc. However, G. R. Jain[25] illustrates it by current atomic constituents like neutrons, etc. It will be aggregate in Jainological terms and hence *skandha*. They are approximately 10^{-13} cm in size according to Yativṛṣabha – a size representing the current nuclear size[26]. This suggests that Jain's illustration should be taken as meaningful. This, however,

creates another problem in explaining the various properties of canonical atoms to be discussed later. Jain and Sikdar[27] have made a basic mistake in assuming this sixth category as atomic on the basis of some later authors[28] despite *"Khandhā Hu Chappayaro"* statement by Kundakunda. This should be rectified and the resultant discussion be modified accordingly. This six-fold classification of aggregates is given in Table 3. This does not find mention in canonical books.

The term *Ātapa* has been treated to mean sunlight rather than heat though it is associated with heat and light – both. But heat, in general, will be involved in fourth category because of its touch effects.[29] This is also a discrepancy. The Einstein's equation gives us a rough idea about the possible mass of energy particles varying between 10^{-37} to 10^{-50} g. in comparision to 10^{-27}g. of lightest atom of 10^{-8} cm diameter[30]. This data further confirms the discrepancy in Kundakunda classification (Table 3). Thus, all the aggregatal classifications seem to be precursors of current classifications based on processes, reactions and factors[31]. Moreover, no symbols or formulae are found in Prākṛta canons for these aggregates.

Table 3 : Six Varieties of Aggregations.

Variety	Example	Perceptibility criteria
1. Gross-gross	Earth, mountains (Solids)	Eye
2. Gross	Water, Oil, Ghee (Liquids)	Eye
3. Gross-fine	Shadow, Light etc. (Energies)	Eye
4. Fine-gross	Gases, tastes, smell, sound etc.	Senses other than eye
5. Fine	Kārmic aggregates	Ultrasensual
6. Fine-fine	Real atoms, karmons, diatomics etc.	Ultrasensual

Methods of Formation of Aggregates and Molecules

The formation of aggregations takes place by mixing and combination of atoms according to the theory of bonding

proposed by Jainas and discussed later and elsewhere[32]. When small number of atoms combine, they form sense-imperceptible aggregates. When many atoms or aggregates combine, they may form gross aggregates. It is stated that aggregatal combination may take place by three mothods[33] :

(i) By division or dissociation of bigger aggregates to smaller ones in size. This ultimately produces atoms in the end.

(ii) By association or sharing of atoms together.

(iii) By a mixed process of association and dissociation.

The dissociation may take place internally or externally as in the case of radioactivity or process of ionisation (not mentioned in canons). We also know today that it may also take place thermally, by application of pressure or particle bombardment. It has been shown later that the atomic aggregation takes place by three methods akin to the three types of valency or bonding of current science.

Canons aim at spiritual development on the basis of law of *karma* -- a form of law of cause and effect with a prospect of mutation. In this connection, canons mention that there is bonding uni-spatially of the living and kārmic matter by the activities – mental, vocal and physical. This bond is continued in later times in succession by two more stages[34]. However, this type of bonding is not subject of physical exploration.

Umāsvāti and Pūjyapāda[35] have pointed out that sense perceptible aggregates are formed by the mixed method of association and dossociation. The latter has illustrated this point by saying that a fine aggregate may be split and its parts may combine with other bigger units to form a gross aggregate. However, Shastri[36] has raised a point whether Umāsvāti's aphorism, *Bheda-saṅghātabhyām Cakṣuśāḥ,* should mean a mixed process or two individual processes. Grammatically, the dual number in aphorism should mean two processes rather than a single one, otherwise, there should be singular number

in the aphorism. There must be some specific object in this composition which the commentators have not elaborated. However, it is quite common to have visible aggregates or molecules by combination of atoms or fine aggregates. Shastri seems to be right to seek how the division as a single process can yield gross aggregates ? There are, however, a number of examples today to prove this. Sulphur dioxide or Carbon dioxide are canonically invisible gases and they, on thermal or electrical decomposition, give solid Sulphur or Carbon *skandhas*. Jain[37] has exemplified these processes by formation of Hydrochloric acid and ionisation of air representing combination and division respectively. Hence visible aggregates are formed both ways and the corresponding aphorism could mean two individual processes also. Nevertheless, examples of molecular formation by combination of the two processes are also available. Thus, the concerned aphorism seems to be superfluous in view of the aphorism *'Bheda-saṅghātebhyaḥ Utpādyante'*. This point requires closer examination in view of recent knowledge.

Conditions for Formation of Aggregates or Molecules

Normally, various types of motions in the molecule-forming atoms are elastic in nature. They are not only irregular but they are non-bonding also. This poses a problem how the bonding takes place and aggregates are formed. *Bhagavatī* mentions two types of bonds – loose and tight which may be equated to physical and chemical bonds[38]. One does not have a clearcut idea whether soul-kārmic matter bond is physical or chemical. Still it is a bond which could be broken only after austere purification processes of many births. It is said to the psychic or volitional bond in contrast to matter bond. Recently the embodied living-karma bond has been pointed out to be approximating the nature of physico-chemical or electro-chemical bond of current science.[39]

The canons assume that the bonding takes place due to partial or total contact between active and colliding atoms

and bonding entities. It is said that the contact by whole leads to homogenous entities like milk and water and hot iron. But of course, only contact does not lead to aggregate formation. It must be forcefully colliding and bond forming. There is collision, but it may lead to change in speed only[40]. Different atoms combine when there is sufficient difference between the velocities of the combining atoms. This could be either internal or induced. This causes inelastic collistion leading to bonding.

Besides contact and bonding collision, difference in nature of bonding atoms (positive or negative) also plays an important part in bonding. This causes natural bond.

The bond could also be formed in the presence of metallic catalysts like containers (there was no idea of modern catalysts) and micro-organisms (alcohol etc.) and changes in conditions (like temperature-heat and now-a-days pressure too). The solar rays also bring out many reactions[41]. The production of natural sparks, burning of planets, eruption of volcanoes are examples of natural bonding by division. Formation of clouds, rainbows, hail-storms, lightning are also other forms in which aggregates are formed, though they represent physical aggregation in most cases. The denaturation of milk and separation of argentiferous ores, inertness of gems and gold and solubility etc. have been mentioned by Akalaṅka as additional examples[42]. Thus, we have physical, physico-chemical and chemical changes under different conditions of aggregates.

We, thus, see that canons mention the various conditions of bonding which are nearly the same as are known today to every High-school student. However, many more agents and conditions like heat, electric current, particle bombardment etc. are now available for this purpose.

Functions of Aggregates or Skandhas

The aggregations have three major functions to perform. The first is physical or physico-chemical. The molecules of our body, mind and other organs are there for proper fun-

ctioning of our life. Current scientists have found the basic unit of living as protoplasm which has a company of molecular structures including nucleic acids. But how this company of non-living molecules bring about life ? This is the problem and a dividing line between science and philosophy. The sign of the living respirations – both ingoing and outcoming are also *skandhas* without which we cannot live long.

The second function of aggregates may be taken as spiritual or supra-sensual. The living beings have feelings of pleasure, pain etc. These depend on physical environment and changes therein which are all molecular. These actually effect the sensing system of our bodies leading to the corresponding sensations. These environments are very fine and consist of even the *karma* particles. Besides our own actions, their effects also lead to a variety of reflex actions and reactions producing characteristic aura around the body. Thus, the molecules not only create our lives, but they effect its course too indirectly. Different glandular secretions effect our mentality. All our tendencies towards better thought and actions are governed by the quality of *karma* molecules getting in and out of bodies. We require better type of molecules for better lives.

The above functions are directly related with our lives. However, the most important aspect of aggregations is their capacity to maintain, modify and form newer and changed objects of different types of molecules. This capacity is the base for development of modern amenities. The purification of water by alum, production of butter from milk, extraction of metals by borax and alkalis are examples of utilitarian changes of chemical nautre. Of course, few examples are observed in canons in this regard. This capacity of aggregation has been explored by the scientists extensively and as a result, we have a world full of entertaining materials. Could we say these materials will not lead to our spiritual development ?

Bhagavatī[43] and Umāsvāti mention six embodiments (earth, water, fire, air, plants, moving beings), five bodies,

speech, mind and respirations as the effects of aggregations. They also mention 14-16 manifestations of aggregations with some variations with *Uttarādhyayana* (16)[44] and Umāsvāti (14)[45]. These consist of some physical energies and some properties in or through which changes are observable. These are shown in Table 4 and have been discussed in proper places in this volume. *Sthānāṅga*[46] points only ten manifestations in contrast. Kundakunda mentions only seven. The symbols U, T. S. and Sth. represent *Uttarādhyayana, Tattvārtha-ṣutra* and *Sthānāṅga* respectively in Table 4.

Table 4 : Aggregational Manifestations.

Non-energy manifestations	Energys forms
1. Bonding (U., T. S., Sth.)	Sound (U.,T. S., Sth.)
2. Shape/form (U., T. S., Sth.)	Darkness (U., T. S.)
3. Division/Dissociation T. S., Sth.)	Shadow or image (U., (U.,T. S.)
4. Touch (U., T. S., Sth.)	Sunshine (hot light) (U., T. S.)
5. Taste (U., T. S., Sth.)	Moonlight (U., T.S.)
6. Smell (U., T. S., Sth.)	Lamplight (*Prabhā*) (U)
7. Colour (U., T. S., Sth.)	(Lustre)
8. Separation (U)	
9. Non-separation (U)	
10. Number (U)	
11-12. Grossness, Fineness (T.S.)	
13. Motion (Sth.)	
14. A-heavy-a-lightness (Sth.)	

Properties of Aggregations

All fine and gross *skandhas* have all the general and specific properties of mattergy. There are eight general and six specific properties of matter. These have already been described. Besides, it may be mentioned that each aggregate has cohesive or adhesive force inherent in it, so that it could combine with its own or different types. There is a variety of action

or motion including rotation, vibration, translation. The translatory motion requires highest energy for chemical bonding. There are some technical terms used in this connection like *parispanda, parivarta, pariṇāma,* etc. which have been explained by Sikdar[47].

Description of Specific Skandhas

The infinite variety of aggregations can be seen to exist in four specific forms – earth, water, air and fire. The order in Kundakunda and many philosophies is different putting fire before air due to eye-perceptibility criteria. Kundakunda mentions them as *dhātus* (basic ones). The four *mahābhūtas* of the Buddhists and four types of basic atoms of Vaiśeṣikas remind us of some conceptual similarities. This four-form aggregation concept suggests that *karma* theory (where *karmas* are also mattergical aggregates) was probably developed later as has also been suggested by Dixit[48]. As the *karma* concept is concerned with spiritualistic discussions, we will skip it here.

It may be suggested that these four aggregatal forms represent the various states of mattergy rather than the specific aggregates. Thus, the earth represents solids, water the liquids, air the gases and fire the various forms of energies. On the one hand, this statement is supported by the fact that the seers have enumerated a variety of earth ranging between 21-40 and involving metals, minerals, non-metals, alloys, ores, gems, compound and mixtures. On the other hand, this surmise becomes little doubtful when one finds that they have classified water, air and fire only in their naturally occurring or commonly observed forms. Though Kundakunda[49] exemplifies ghee, oil etc. among the gross (liquid) class, still they are not mentioned in water varieties. How they could overlook the enormous variety of liquids and gases is a matter of surprise and clarification. It could also be surmised that other varieties of different classes might not be known at canonical times.

Another fact stated in canons is that all these *skandhas* or the visible world is basically termed as living during their

growth and development[50]. Their internal heat, hardness or adhesiveness has been taken as sign of their livingness. However, they turn non-living by heating, solution, cutting or weapon operation. We shall describe them as in canons.

The Earth

The earth, representing the class of solids, is characterised by different degrees of hardness. It has valuables under and over it. *Ācārāṅga*[51] and *Mūlācāra*[52] have classified the earth in the first instance followed by others later. The canonical description is based on its assumption of being one-sensed living one. Though canons do not have it but Pūjyapāda[53] has classified it in four categories of (i) earth, (ii) earth-body, (iii) embodied earth and (iv) would-be living earth. Similar classification exists for other aggregatal forms like water, etc. Out of them, the first and second are clearly non-living, the third has been called living, because of its being substratum for living entities. The fourth variety also seems to be living system about which no tangible clarification is available. No other realistic system agrees to livingness of the earth in any way. Currently, it is debatable whether living characteristics apply to earth as a class. However, it has been shown to have many types.

It has been observed that a number of older canons and pro-canons do not have much details about the earth. However, the earliest mention of some of its varieties are traceable in *Ācārāṅga* and *Daśavaikālika*[54] (i. e. about 427 B. C.). They mention four types of earths-rocks, lumps, stones and sands. Later on, these types have been expanded. Scriptures have mentioned its two broad types – soft and hard. The soft one has five or seven-coloured varieties as shown in *Prajñāpanā*[55] (P) and *Ācārāṅga-niryukti* (A. N.). They are as below :

Red, Green, Yellow, White, Black-coloured earths. (A. N.)

Red, Green, Yellow, White, Black, Pale-white (*Pāṇḍu*) and algae (*panak*) earths (P).

The hard types are shown in Table 5 as found in canonical literature. Though there seems to be large amount of similarity in these types, still some additions and deletions forecast many informations. The *Ācārāṅga Niryukti* contains all solid earths, the 14 gems being additional to the list totalling 35. In the second classification of about 250 years later, not only gems included in the list but their number also increase from 14 to 18. Moreover, mercury is also added to the metals. This is an exception to the class of solids. This suggests that mercury was discovered or put to use between 500-300 B. C. Though Śāntisūri follows *Prajñāpanā,* but he has curtailed the number to 21 by condensing the gems to three types and seven metals to one type. Some new substances like chalk and soda have also been added with the exclusion of diamond and pebbles, etc. Amṛtacandrasūri follows *Mūlācāra* with 21 substances and 15 gems making the total to 36 earths. The last two classifications add pewter to metals which is actually an alloy. Sūri has made *Masargalla* variety into two types.

Table 5 : Various types of Earth.

	UTN 40	A 35	MR/TS 36	PRJN 40	Śānti Sūri 20
	1	2	3	4	5
1.	Soils	Soils	Soils	Soils	Soils
2.	Stones	Stones	Stones	Stones	Stones
3.	Slabs	Slabs	Slabs	Slabs	–
4.	Pebbles	Pebbles	Pebbles	Pebbles	–
5.	–	–	–	Kirelaka	–
Metals					
6.	Iron	Iron	Iron	Iron	Gold etc.
7.	Copper	Copper	Copper	Copper	–
8.	Lead	Lead	Lead	Lead	–
9.	Silver	Silver	Silver	Silver	–
10.	Gold	Gold	Gold	Gold	–
11.	–	–	–	Mercury	Mercury

1	2	3	4	5
Alloys				
12. Pewter	–	Pewter	Pewter	–
Non-metals				
13. Diamond	Diamond	Diamond	Diamond	–
Mineral/Compounds				
14. Salts	Salts	Salts	Salts	Salts
15. Usam	Usam	Usam	Usam	Soda Sulphate
16. Yellow Orpiment	Yellow Orpiment	Yellow Orpiment	Yellow Orpiment	Yellow Orpiment
17. Vermillion	Vermillion	Vermillion	Vermillion	Vermillion
18. Realgar	Realgar	Realgar	Realgar	Realgar
19. Ant. Sulph.	Ant. Sulph.	Ant. Sulph.	Ant. Sulph.	*Sauvīrāñjan*
20. Mica	Mica	Mica	Mica	Mica (5 col.)
21. Sand	Sand	Sand	Sand	–
22. Fine sand	Mica sand	Mica sand	–	Sand
23. –	–	–	Chalk	–
24. –	–	Cop. Sulph.	–	–
Natural Substance				
25. Coral	Coral	Coral	Coral	Coral
Gems				
26. *Gomeda*	*Gomeda*	*Gomeda*	*Gomeda*	–
27. *Rucaka*	*Rucaka*	*Rucaka*	*Rucaka*	Gems
28. *Sphatika*	*Sphatika*	*Sphatika*	*Sphatika*	*Sphatika*
29. *Lohitākṣa*	*Lohitākṣa*	*Lohitākṣa*	*Lohitākṣa*	Jewels
30. *Marakata*	*Marakata*	*Bappaka*	*Marakata*	–
31. *Masargalla*	*Masargalla*	*Masargalla*	*Masargalla*	–
32. *Bhujmodak*	*Bhujmodak*	*Bhujmodak*	–	–
33. *Aṅka*	*Aṅka*	*Aṅka*	*Aṅka*	–
34. *Indranīla*	*Indranīla*	*Indranīla*	*Moca* or *Nīla*	–
35. *Candra-prabha*	*Candra-prabha*	*Candra-prabha*	*Candra-prabha*	– –
36. *Vaidūrya*	*Vaidūrya*	*Vaidūrya*	*Vaidūrya*	–

1	2	3	4	5
37. *Jalakānta*	*Jalakānta*	*Jalakānta*	*Jalakānta*	–
38. *Sūryakānta*	*Sūryakānta*	*Sūryakānta*	*Sūryakānta*	–
39. *Candana*	–	*Candana*	*Candana*	–
40. –	*Maṇikānta*	–	–	–
41. *Gairika*	–	*Gairika*	*Gairika*	–
42. *Pulaka*	–	*Pulaka*	*Pulaka*	–
43. *Saugan-dhika*	–	*Saugan-dhika*	*Saugan-dhika*	–
44. *Hansa-garbha*	–	*Hansa-garbha*	*Hansa-garbha*	–
45. –	–	*Pāṇḍuraṅga*	–	–
46. –	–	*Rucakāṅka*	–	–
47. –	–	*Puṣparāga,*	*Baka*	–
48. –	–	*Rucakāṅka*	–	–

On chemical examination of these various earths, it is seen that they contain elements, compounds, minerals, alloys, gems and mixtures known during different canonical periods. The earths are said to be carriers of many valuables. *Daśa-vaikālika* mentions 24 such valuables including some trees and medicinal plants but excluding cereals and pulses[56].

Gold has an important status among all the solids. It was used for coins, ornaments and medicines. It is said to be anti-posion and rejuvenator. It was taken to be an auspicious metal, inert, unattacked by fire and valuable. Its purity is judged by heat resistence, beating, rubbing and drilling. It was assumed that when lead was converted into gold, many factors including vital force worked. It is obtained by heating its ores with salt and borax. Other metals are also obtained similarly[57]. Artificial gold has also been mentioned in *Niryuktis.* Tempering has been one of the ways to improve the qualities of iron. Description of other earths or metals is not available in canons.

The earths described above form the gross class. There are fine earths too. They are found everywhere in the

universe and they belong to one type only. They are invisible aggregates. They are infinite in number[58].

The above canonical description about solids seems to be quite small and incomplete when compared with current knowledge. There are thousands of compounds and minerals known today. Many useful materials are being synthesized now-a-days. Canons deal with only natural earths. Still, it proves that the ancient scholars did observe what was existing.

The *Vaiśeṣikas*[59] have only three types of earth-soils, rocks and minerals and immobiles (vegetable kingdom). Later, Annam Bhaṭṭa omits the last category and adds the word etc. inclusive of many solid and liquid materials found in nature[60]. The Jainas have a separate category for vegetable kingdom to be described later. That is taken as living rather than non-living. Table 5 indicates the Jaina advances over the Vaiśeṣikas in this regard. Praśastapāda exemplifies each of three categories in general but the Jainas have gone specific. The Buddhists have not much to offer in this matter.

The Water Class

Like earth, water should represent liquid class. The factual description is different. However, water is divided in two classes – fine and gross. The fine variety has similar specifics as the fine earth. No examples of fine variety are available. However, gross water could be of three types – (i) general water (*pānīya*), (ii) alcohols (*pāna*) and (iii) medicinal waters (*pānaka*[61]). Fluidity is the chief characteristics of this class. Many substances like butterfat, metals, etc. could get into this class when heated and liquefied. They therefore casually belong to this class.

Ordinary water has two varieties – overground and underground. They have been sub-classified in different canonical periods, as shown in Table 6. The *Prajñāpanā* gives the best classification with seventeen varieties of water liquids including all the above three major varieties. *Mulācāra* and

Amṛtacandra have nothing special. *Jīvābhigama* follows mostly *Prajñāpanā*. *Uttarādhyayana* and *Daśavaikālika* are nearly similar with less varieties in comparison to later literature. Śāntisūri has seven varieties on which the earth rests.

Table 6 : Various Types of Water in Jaina Canons.

	UTN 5	DSV 5	MR/TS 6	PRJN 7	Śānti Sūri 7
Overground Waters					
1.	Dew	Dew	Dew	Dew	Dew
2.	Ice	Ice	Ice	Ice	Ice
3.	Mist	Mist	Mist	Mist	Mist
4.	Hails	Hails	Hails	Hails	Hails
5.	Water-drops on greengrass	Water-drops on greengrass	Water-drops on greengrass	Water-drops on greengrass	Water-drops on greengrass
Under-ground Water					
6.	*Udaka*	*Udaka*	*Udaka*	Pure *Udaka*	Rain water
7.	–	–	–	–	Dense water
8.	–	–	–	–	Water, Well,
9.	–	–	–	–	River etc.
10.	–	–	–	Cold	–
11.	–	–	–	Hot (spring)	–
12.	–	–	–	Alkaline	–
13.	–	–	–	Slight acidic	–
14.	–	–	–	Acidic	–
15.	–	–	–	Salt/Sea water	–
				Wine (*Varuṇa*) water	–
16.	–	–	–	Milk (*Kṣīra*) water	–
17.	–	–	–	Butter (*Ghṛta*) water	–
18.	–	–	–	Sweet (Cane) water	–
19.	–	–	–	*Rasodaka*	

There are two types of creatures found in water-air born and water born (*Vāyu-yonika* and *Jala-yonika*)[62]. The normal water is purified by boiling or by using alum. It is said that the ascetics should use the water cooled after boiling. The pure water becomes substratum for micro-organisms when kept for 12-24 hours. Fermented or lemon waters are acidic which increases on keeping them longer due to further fermentation where alcohol or vinegar is produced. These waters should not be used for drinking. The *Prajñāpanā* description about the sources of water is quite satisfactory. But they describe only solid or liquid water. Gaseous water does not find any mention in canons or later pro-canons.

Jīvābhigama[63] mentions about 21 sources from which different types of alcohols or alcoholic medicinals could be prepared. Many partially fermented waters are included in *Prajñāpanā* waters. *Mūlācāra* points out that their eatability is only limited upto 24 hours fermentation[64].

The general canonical literature does not contain much about alcohols and medicinal waters. However, *Jīvābhigama* points out that these increase the strength of the body and health. These liquids form the subject of other faculties. It has been pointed out that they should not be used for better health and spirits. Amṛtacandra[65] has described alcohol as a source of many micro-organism and it causes intoxication and idleness. Butter is also produced by similar process. One does not have much description about liquid oils. However, butter and oils form a class of liquids which are water insoluble. Many other liquids are water soluble. They are described to some extent in Āyurvedic texts.

Jīvābhigama mentions the shape of liquids in the form of water-drops (spherical) in contrast to circular shape of the earths basically[66].

It seems from the above that there were three main types of liquids in the olden times. Their number has grown enormous today. Their properties vary. The earlier description

of general properties show that quite a good number of liquids are found in canons. The Vaiśeṣikas have sea, river, dew and ice-water with many other varieties included in the word 'etc.' not mentioned specifically[67]. This seems to be much less than what is described in Jaina literature. The Buddhists have also a similar case as with the earths.

Current science has gone sufficiently ahead of canonical age not only in the number of liquids, but their classification ways and qualitative and quantitative properties. A good amount of knowledge about them has been added.

The Air or Gaseous Aggregates

As earlier, the air should represent the gaseous class of substances. They move in all directions. Formerly, only colourless gases might be known which were not visible to the eye but other senses could sense them by their blowing, flowing or smell and touch. It seems, however, that no other gas except air was known in canonical periods. That is why, only various types of airs are described in this category. The earths and water fare better in this regard though to a very small extent.

Air has been classified differently in different periods as shown in Table 7. *Daśavaikālika* classifies it in seven types – a common-sense view. But there is a peculiarity. Air from mouth is also included in it. It is now taken as chemically different from normal air in the sky. Other airs may be called non-violent airs or breezes. *Prajñāpanā* has a better classification of air consisting of 19 varieties depending on direction, velocity, action or physical state. Śāntisūri has eight varieties which include air from mouth and some other *Prajñāpanā* varieties. *It has excluded all directional winds. Battakera and Amṛta*-candra have seven varieties excluding mouth air. All these categories do not include air from nose without which our life would be in danger. Per chance, this could be taken as included in mouth air though it is compositionally different. Of course, if

the concept of *prāṇas* as substance is taken, respiration may include it.

Table 7 : Various types of Airs in Jaina Canons.

	UTN 6	MR/TS 7	PRJN 19	Śāntisūri 8	DSV 7
	Wind blowing	Wind blowing	Wind blowing	Wind blowing	Fan air
1.	Upwards	Upwards	Upwards	Upwards	Leaves, Air
2.	Downwards	Downwards	Downwards	Downwards	Air, breeze
3.	Whirlwind	Whirlwind	Whirlwind	Whirlwind	Air, cloths
4.	Singing air	Singing air	Singing air	Singing air	Air, hand
5.	Dense air	Dense air	Dense air	Dense air	Air, feather
6.	Breeze, Pure air	Breeze	Breeze	Breeze	Air, mouth
7.	–	Rarefied air	Rarefied air	Rarefied air	–
8.	–	–	Air from mouth	Air from mouth	–
9.-16.	–	–	Air of eight directions	–	–
17.	–	–	Stormy air	–	–
18.	–	–	Air, destructive		–
19.	–	–	Wind in Waves		–

Some properties of air find mention in canons. It has been said that it helps combustion while the whirlwind obstructs it.[68] It is inhaled and exhaled by the body. Its mattergic and aggregatal nature can be proved by its obstruction, subjugation and resistance by material objects.[69] *Bhagavatī*[70] mentions its property of contraction and expansion. There are many types of micro-organism in air. Their properties have come to be known quite late in Pasteur's time. Airs have kite shape.

Though air is an aggregate but there is no mention whether it is a mixture or a compound. The canons contain meagre physical or chemical properties about it. Now it is known as one of the many gases, some of them coloured (Chlorine, Nitrogen Peroxide etc.) and many colourless

(Carbon Di-oxide, Cooking gas etc.). They could be liquefied and solidified. They could be put to a large number of uses including medicines, pesticides and polymers.

The *Vaiśeṣikas*[71] have obliquely moving air recognised by touch and inferred by a-hot-a-cold touch, production of sound and vibrations and by causing lighter bodies to float in the sky. Despite mentioning of innumerable varieties, they have pointed only inhaling and exhaling airs present in all parts of the body. Its obstruction has also been mentioned to show material aggregatal nature of general air. It is said that it causes bio-chemical processes to proceed and the body to run — a fact mentioned by the Jainas due to fires. The Buddhists have air as primary matter with not much details about it.

The Fire or Energy or Taijasa (Caloric) Aggregates

The fire or *Taijasa* aggregates represent various types of energy particles. Some of them like light are visible by sense of sight while others are perceived by senses other than sight (Heat). Basically sunrays or fires are called *Taijasas.* They are hot by nature — a point not mentioned in canons but observed physically. That is why sound energy is not called so. The *Prajñāpanā*[72] classifies these aggregates in two forms — fine and gross. It is the gross variety which has been classified in canons and shown in table 8. The flames (with or without light) are known forms of fires. *Daśavaikālika* mentions seven forms while *Prajñāpanā* points atleast twelve forms. Others mention their own numbers. *Jīvābhigama* follows *Prajñāpanā* and mentions its shape as needle type. If one takes pure fire as fire produced from non-traditional fuels or without fuels (striking stones, bamboos and gems, fire burning through glass or gems) and star burnings, electric lightnings etc. are all included in *Ulkā* variety, then there is not much difference in the varieties of fires by different authors. It may be guessed that those mentioned ones are not the only fire aggregates but there may be many more as the authors use the word etc. They have done so in the case of waters and earths too.

Table 8 : Various Types of Fires in Jaina Canons.

	UTN 6	DSV 7	TS 6	PRJN 12	Śāntisūri 7
1.	Burning coal with-out smoke	Burning coal with-out smoke	Burning coal with-out smoke	Burning coal with-out smoke	Burning coal with-out smoke
2.	Straw/cow-dung fire	Straw/cow-dung fire	Straw/cow-dung fire	Straw/cow-dung fire	Straw/cow-dung fire
3.	Flame	Flame	Flame	Flame	Flame
4.	*Ulkā*	*Ulkā*	–	*Ulkā*	*Ulkā*
5.	Pure fire	Fuel-less fire	Fuel-less fire	Fuel-less fire	Fuel-less fire
6.	Electric lightning	–	–	Electric lightning	Electric lightning
7.	–	Half-burnt	–	Half-burnt	–
	–	Wood fire	–	Wood fire	–
8.	–	Common fire	Common fire	–	–
	–	–	–	Star fire	Star fire (*Kanaka*)
9.	–	–	Lamp fire	Lamp fire	
10.	–	–	–	Fire by rub-bing	
11.	–	–	–	Gem fire	
12.	–	–	–	Nirghata fire	

The above fire aggregations have three aspects — heat, light and electric lightning which is produced by difference in charges. Thus, it may be inferred that the term *Taijasa* has included energies (of today) known during the canonical periods. The important point to be noted here is that the electric lightning or its forms in the sky has been taken as fire aggregates. These are natural forms of electricity. All these are described in Physics rather than Chemistry of today.

Shastri[73] has raised a point on the nature of *Taijasa* (luminous) body-fourth out of five bodies living beings possess.

It is the cause of heat, activity and digestion in the body. It is said to be fire invisible, devoid of impediments, caused by supernatural powers and luminating others while luminous by itself. It consists of an aggregate of infinite atoms (real) which are infinite times the number of atoms in earlier bodies. Due to dense packing, the overall size becomes finer. The luminous body is made up of energy aggregates or *Taijasa* variforms (*vargaṇās*) whose size is between *āhāraka* (ejectable, heat) and *bhāṣā* (sound) variforms[74]. Jain and Javeri[75] have called it as electrical or electro-magnetic in nature. This is found in every living beings from birth to death and even post-death state. Many have called it as caloric (heat ?). Per chance, heat generated by *āhāra* (food) is converted into this energy for the body to be active and living. It may itself be inactive but it makes the others active. Thus, the *Taijasa* body is thermal or electrical form of the fire aggregates. Akalaṅka[76] mentions a number of times that heat and light are simultaneous in sunlight and they cause sweating and digestion due to heat content. He also mentions that fire bakes the earths, gets absorbed in materials like metals etc. in addition.

He has defined *Taijasa* as white lustrous (*Prabhā*) light. It could be described in fourteen ways somewhat different from descriptions of today. Accordingly, it is as white as cronch. It produces anger and happiness in the living (due to digestional secretions) and creates burning and combustion in others. Its size is innumerableth part of an *aṅgula,* i. e., less than 10^{-15} cm. It is infinite and universal. These points are based on the aggregatal nature of the fire body. It exists in the form of fine particle basically and forms aggregates. This description requires deeper studies for comparative evaluation.

Thacker[77] has raised one more point regarding the livingness of light and electricity, i.e., fire energies. The commentator of Haribhadra[78] has given many arguments for the livingness of all the above four types of aggregates including air and fire on the ground of their heat content, growth under

favourable conditions and other factors. It seems these represent the animistic trend of early Jainism as found in canons. However, the current science does not agree with these arguments and points out their non-living nature though the canons tell us these could be bothways. For example, air is necessary for life and lamps cannot burn without it. In contrast, electric lamps burn only in an airless atmosphere. These could become non-living by many processes some of which are mentioned in *Ācārāṅga* even.

The *Vaiśeṣikas*[79] presume *Taijasa* atoms with hot touch and white glistening colour. They consist of four forms — fuel-fire, sky-fire, biochemical-fire and mineral-fire. Out of these, the Jainas have only the first two. The biochemical-fire or heat is produced in the body by which it functions due to digestional conversions of various intakes. It is termed as stomach-fire. Mineral-fire is said to be found in many minerals containing gold, silver etc. This is not acceptable to the Jainas who also do not aggree to the exclusive nature of hot touch to the fire aggregates which include gem fires too. Buddhas have *Taijasa* as an aggregate with hotness causing cooking of materials. Table 8 clearly indicates that the Jainas have detailed the *Vaiśeṣika* fires.

Physical and Chemical Changes in Aggregates Mentioned in Canons

The canons do not mention the changes in mattergy in terms of current knowledge about bonding. However, many of the changes have been mentioned which could be classified under the current heads. The physical changes are temporary, reversible easily without changing the internal nature of the constituents and they generally do not follow any law. The chemical changes are just the reverse and follow laws of chemical combinations and bonding. They are generally irreversible but they could be reversed under harder conditions. A selection of phenomena found in canons are classified below in table 9. It is clear that majority of changes or phenomena

mentioned in the canons are physical. They have been mentioned in connection with explaining religious or philosophical facts so that they may be easily intelligible to laymen. They, however, represent what was commonly known at those times. The chemical changes are few and indicate some processes in common use. They have also the illustrative purpose. It is, however, learnt that there are very few of chemical/physical processes mentioned in the canons. Quite a good number of them are found in *Prāṇāvāya* treatises. Still, scholars of today can easliy feel how scanty had been our knowledge in practical fields. We did not try to improve upon it for centuries and are now feeling for lagging behind seriously in current age.

Table 9 : Classification of changes mentioned in Canons.

(a) *Change of States : Physical Changes*

(i) Heating, cooling and solidification of milk.

(ii) Liquidity of earths, solidifaction of water, solidification of gases.

(iii) Old Molasses and old ghee.

(b) *Physical phenomena*

(iv) Formation of clouds and sky-tree.

(v) Rains, fogs, lightning.

(vi) Storms and hailstorms.

(vii) Rainbow.

(viii) The aura and lines surrounding sun and moon.

(ix) One to multi-atomic mattergy.

(x) Fabric made from fibres.

(xi) Absorption of fire by metals.

(xii) Separation of gold from auriferrous sands of *Kurukṣetra.*

(xiii) Raw pitcher from wet clay-mixture.

(xiv) Mixture of oil and water.

(xv) Precipitation of salts on woods in salt solutions.

(xvi) Poisoning or bitter-tasting of eatables by poisonous or bitter substances.

(xvii) Swarming of dust particles in sweet wet jaggery.

(xviii) Inertness of gold, gems etc. in dirty places.

(c) *Chemical/Physico-chemical Changes*

(xix) Formation of alcohols from materials mixed with ground powders of enzymes (*kiṇva*).

(xx) Baking of earths and raw pitcher.

(xxi) Burning of lamp with wick and oil.

(xxii) Precipitation of pearls from water ($CaCo_3$).

(xxiii) Agricultural crop from seeds through water, sun-light and soil.

(xxiv) Production of fire by rubbing woods or stones.

(xxv) Souring of various washings by indirect/direct fer-mentation.

(xxvi) Extraction of metals from their ores.

(d) *Undefined bonding*

(xxvii) Bond between the living and fine *kārmic* aggre-gates.

(xxviii) Bond between pure soul and *karmas.*

(xxix) Emulsion (milk) and diffusion (fragrance in flow-ers) processes involving weak electrostatic forces.

Conclusion

The above description of theory of aggregations and specific aggregates of Jainas confirm that the theoretical concepts in this regard stand on better footing than the practical side. The description of visible or gross world seems to be quite incomplete and small. It must however be admitted that *Prajñā-panā* gives the best details of the period. Another fact emerging from the above is that the canons have differing or modified contents in nearly every specific case. It is therefore very necessary to collect and co-ordinate the material to present to the current man.

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Chapter 7

Jaina Theory of Atoms

Constitution of Gross Matter

The question regarding basic nature and constitution of gross matter has been the subject of speculative study since the earliest times. It is only in recent centuries that a large amount of progress has been made in our understanding in this regard. Most philosophers postulating the material world as real propose that the gross matter is made up of smallest particles called atoms (*aṇus* or *paramāṇus*). The eastern philosophers generally have coined the word *aṇu* for the smallest constituents. However, Vātsyāyana[1] has differentiated them from *paramāṇus* which make up *aṇus.* The Jainas have the word *aṇu* for this smallest particle. It will be shown that the term used for basic particles could be taken as equivalent to the current term -- atom for comparative elaboration and evaluation. Besides Jainas, Ājīvikas, Cārvākas, Buddhas, Vaiśeṣikas and Greeks also have their atomistic theory for gross matter. This is being treated after the gross matter because of its fineness and intellectual conceptualism.

Historical Perspective of Atomic Theory

Though Sarton[2] refers to some historically unverifiable record of Phoenician thoughts regarding earliest conception of atomic theory dating as early as 800 B. C., but Basham[3] seems to be more realistic in pointing out the earliest authenticated instance to thoughts on atomic origin of mattergy to *Prakṛddha* and *Ājīvikas* dating 600-544 B. C. It is opined that the atomic theories of Jainas, Buddhas, Vaiśeṣikaś, Cārvākas and others seem to have these earlier theories as their base and, therefore, have developed later.

It is very difficult to state the chronological order of

development of various Indian philosophical systems. They all have sufficiently pre-Christian era of development as approximated by prominent scholars[4] and given below in Table 1. Their literature grew first by oral tradition and then in script form some two to three hundred years later. The major commentaries developed later between second and ninth centuries A. D. elaborating and incorporating the newer tenets on this theory. It is clear from Table 1 that Gośāla was senior to Mahāvīra and others[5], and in turn Mahāvīra and his literature is the first to be counted authentically. All other systems seem to be junior in all respects. It should, however, be mentioned that some scholars hold different views about contents of Table1[6] but the majority subscribes to it. Nevertheless, the table supplements and supports the contention of Rieppe as above.

Table 1 : Approximate dates of origin and first literature of Indian systems of philosophy.

System	App. Hist. Date	First Literature
1. Maṅkhali Gośāla (*Ājīvaka*)	600-544 B. C.	—
2. Mahāvīra (Jaina)	599-527 B. C.*	App. 400 B. C.
3. Buddhas	599-486 B. C.	300 B. C.
4. Sāṅkhyas	500-400 B. C.	150 B. C.
5. Cārvākas	600-400 B. C.	150 B. C.
6. Vaiśeṣikas	500 B. C.	300 B. C.
7. Democritus (Greek)	420 B. C.	420 B. C.

* 540-468 B. C. under current thoughts.

Despite *Prakṛddha* belief in seven elements — water, fire, air, earth, soul (life), joy and sorrow — in the world, the Upaniśadics, Ājīvikas, Cārvākas, Buddhas and Vaiśeṣikas had four basic *bhūtas, dhātus,* elements or atoms. The contemporary Sāṅkhya school seems to have peeped a little deeper in assuming a formless matter (*Prakṛti*) as the fundamental cause to produce infra-atoms or *tanmātrās,* subtle senses and they leading to fine and gross senses and matter. The earliest

Sāṅkhya literature does not mention the word *aṇu* or *paramāṇu* but later scholars like Vijñānabhikṣu introduced it in their works equating *tanmātrās* as the essence or infra-atoms[7] causing the formation of fine and gross world. This *tanmātrikā* system is more imaginary and philosophic than the atomist system.

In contrast, the Jainas have a clear exposition of atomic base of the universe.

From the above, it may be opined that eastern atomism had its origin during 600-500 B. C. Democritus of Greece also happened to be living during 460-370 B. C. who developed atomism in the west out of inconsistencies of various theories of unitary elements from Thales to Empedocles (500-440 B. C).

It would be very difficult to tell who is the first originator of atomistics. The east, however, wins the race as far as timings are concerned. It is also surmisable that each system developed its theory independently in the east and west as well on philosophical conceptual basis. There is no proper record to confirm either intellectual contacts or literature of this period between the two regions despite Mellor's[8] suggestion of a historical possibility that the Greeks were influenced by Indian thought travelling through Persia. Rieppe[9] definitely points out that the east has not been influenced by the west despite the fact that there are many similarities in approach and conceptions on many philosophical problems. However, it may be said that the development of various atomic theories took place during a very small period of time (about a century).

Table 2 summarises various atomic concepts. It will be clear that the eastern atomism excels not only the Greek one but the Daltonian one also in many respects. Also, the Jaina atomism, in particular, seems to be quite advanced contemporarily and even much akin to many concepts of twentieth century. The distinctive features of Table 2 lend support to this view.

Equivalence of Aṇu or Paramāṇu with Atom

Nearly all realistic systems presume atoms as the basic unit of matter. However, it is only in early Vaiśeṣika and Jaina literature that this has been postulated to a credible extent. They have been led to it from the four types of gross bases which were supposed to be pre-mordial substances. However, the nature of atoms varies in each system. Before we describe them, it will be pertinent to establish the equivalent meaning of the word *aṇu* or *paramāṇu.*

Despite the fact that the scientific world has accepted the divisibility of atoms into large number of constituents on the basis of early twentieth century discoveries, the Indian atomists, specially the Jainas have been unable to agree to this fact[10]. Many Jaina scholars have, therefore, tried to suggest the various equivalents for the canonical *'aṇu'* or *'paramāṇu'*. Their main point in this regard has been the concept of indivisibility together with the size of real atoms which has been shown to be approximately 10^{-13} cm.[11] The validity of these facts has been associated with the view of absolute knowing capacity of the Jaina seers (omniscients). Barring super-humanistic elements, the canons are found to have many flaws accepted by Vaiśeṣikas and Jainas too flouting their authenticity on the basis of non-contrariety and consistency. The traditionalists, however, would not agree to flaws in the canons. Hence, they would consider the canonical atom as equivalent to some smaller but indivisible constituent of current atom. Prof Jaina[12] equated them formerly to ionised atoms, stripped atoms and then to electrons, positrons etc. and now to a new particle quark (3 Q = 1 proton). Javeri[13] has gone further to equate it to mere energy. The Jainācāryas have, however, shown some genious to solve their own problem by assuming two types of atoms — fine or ideal atoms to be innumerableth times finer than the real ones[14]. They have also postulated two types of real atoms– one supposed to be without mass (*aguru-laghu*) and the other with mass (4-touch and 8-touch atoms)[15].

Table 2 : Comparative Properties of Atoms in Important Systems.

	Properties	Greeks	Vaiśeṣikas	Jainas	Current atom
1.	Nature	Non-living	Non-living	Non-living	Non-living
		Smallest unit	Smallest unit	Smallest unit	Small unit
2.	General properties	Eternal	Eternal	Eternal, Non-eternal	Eternal, Changing
		Indivisible	Indivisible	Indivisible, divisible	Divisible
		Invisible	Invisible	Invisible	Instrument-trackable
		Indestructible	Indestructible	Indesructible	Destructible in energy.
		Impenetratable	Impenetratable	Impenetratable, hollow	Penetratable
3.	Shape	Different shapes	Space Point, Solid	Space point, Hollow	Hollow, Spherical, Elliptical
4.	Size	Different Sizes	10^{-4} cm (1/6 sunrays)	10^{-13} cm	10^{-5} cm
5.	Qualities	No colour, taste etc.	Touch, taste, colour	T, Ts, C, S	T, C, Shape
		Matter association	Smell, Association	Matter, Energy	Matter
				Association, dissociation	Association, Dissociation
6.	Forms	–	–	Two : 4-Touch, no mass	–
				8-Touch, with mass	
7.	Number/Types	Many	4 (Earth, Water, Fire, Air)	Fundamentally one	109
				16 (T, Ts, C, S)	Real
				200 (Due to Prominence of Qualities)	
8.	Identification	–	By effects	By effects	Wilson tracks

9. Motion, cause of.	Dynamic	Primarily at rest, motion due to vital force	Natural, external	Natural, external
10. Motion, types	Linear, collision	Not specified	Irregular Vibration, rotation Linear, translation	(i) Irregular (ii) V, R, Tr & spin Linear
11. Speed	—	—	One space point to the end of universe per unit samaya (10^{27}-10^{47} cm)	Measurable speed, minimum, 10^{5} cm maximum, 3 x 10^{10} cm (Light)
12. Bonding	By collision	By Vital Force By association, Thermal Energy	Chemical by 3 methods (Modified Version)	Three Vaience types
13. Transformation	Dissociation-cum-association, living matter can be produced from atoms.	Heating of gross matter	Association, Dissociation mixed process, no living from atoms	Displacement methods living matter from atoms Chemical by full contact Physical by partial Contact
14. Cause of bonding	—	—	presence of adhesivity, Contact, quantitative electrically opposite nature (*Snigdha*, +; *Rukṣa*, –)	Opposite electrical nature, catalysts, contact, other agents

On consideration, these contentions are crowded with many problems. Some of which are given below :

(a) Firstly, on the basis of size, the atom is supposed to be of point size. This will mean a solid atom as the point is the beginning, center and end of itself. This will further mean that the property of vast contraction and expansion will not stand scrutiny. Thus, the hollowness of the atom will not be substantiated[16].

(b) The various types of motions of atoms described (see below) can also not be explained on the basis of space point size.

(c) The Jainas assume their atoms to be of same shape (shapeless), size and type irrespective of the gross matter they form. Their equation of these atoms to current atomic constituents like electrons, etc. will mean atoms of at least two types. The space point shape proves them to be particulate in nature. Their sense-imperceptible form (or rupiness) also supports this view.

(d) The Jainas have formulated rules for bonding of atoms among themselves and with other molecules forbidding the bonding of similarly charged similar atoms. However, formation of heavy electrons, protons and even of elementary molecules goes against this rule. Prof. Jaina[17], Sikadar[18] and others have not given any clue to this point.

(e) The equivalence of atoms with radiant energy is also not creditable as the energy particles (if they are like photons, nutrinos etc.) have smaller mass and sizes as postulated. Moreover, it will be very difficult to explain how gross matter could be formed from these energy particles with the amount of energy normally utilised in normal chemical transformations like formation of molecules of even elementary atoms. The fusion process of light atoms like hydrogen to helium has not been possible in practice for the last fifty years.

These and many other difficulties lead one to have a

more realistic view about the equivalence. The best point is to have the word *paramāṇu* in its historical perspective and equate it to the contemporary atom of Vaiśeṣikas, greeks and Dalton even. It is only then that its properties could be compared and evaluated.

The Vaiśeṣika atom[19] has also a point size but its dimensions are about 10^7 (a crore) times larger than the Jaina real atom of canons. Thus, it is really an atomic or molecular aggregate in current or even in Jaina terms. Surely, it could be easily divisible and weighted. There is, thus, no comparison of this atom with the Jainas or the current atom of 10^{-8} cm. size. However, we will presume the Vaiśeṣika atom with the same view as above for our comparison.

The Sāṅkhyas are not basically atomists but Sikdar[20] has suggested their *Prakṛti* to be equated with atom. However, the nature of this agency is not in tune with the activities of the atom. Secondly, how an atom could form *tanmātrika* infra-atom ? It is like a vital force which the Jainas would not agree with. Sanghavi[21] has suggested that the Jainas have the synthesis of their atom from the Sāṅkhyas and the Vaiśeṣikas in their fine and real variety.

It may be pointed out that there are some Indian systems like Śaṅkara's *Advaita-vedānta* and Buddhas *Vijñāna-vāda* who do not agree to atomism as the cause of gross matter. They have refuted atomistics logically. However, it holds sway over these systems and has got support from modern science.

Definition of Paramāṇu or Atom

Of all the canons, *Bhagavatī*[22] is most important in giving many details of atomic concepts of the Jainas. They are followed by pro-canons written by Kundakunda[23] with some additions to the theory. Table 2 points out the distinctive features of the Jaina theory comparatively. It is found that all systems of atomists agree an atom to be non-living, basic and

finest constituent of matter with the qualities of indivisibility, impenetratibility, incombustibility and sense-imperceptibility. It is a true point without dimensions. It is ultimate and eternal unit. Despite its basic eternal nature, it undergoes changes to form molecules and gross matter. In contrast with the Greeks, the Jainas and Vaiśeṣikas have attched touch, taste, smell and colour to it with the difference that the Jainas presume all the four qualities co-existing in all atoms. It can easily be guessed that the Jaina view is more scientific. This is exemplified by air when it is liquified. Earth and water definitely have all the four. Fire atoms have been shown to possess taste and smell too[24]. The Vaiśeṣika statement[25] of other than specified qualities in atoms being not natural but casual does not, thus, stand scrutiny. These qualities have been classified and we find a good amount of difference there too as shown earlier. It is because of these qualities that the atom and matter are termed *'rūpī'* or with form.

It is said that at least five out of twenty sub-classes of these qualities exist in an atom at a time — 1. taste, 1. colour, 1. smell and two touches (temperature and one of the electrical natures)[26]. The basic atom is, thus, a 4-touch one. The real atom may be 4-touch or 8- touch one. Other qualities develop later. This suggests that mass and density are not assumed to be basic properties of atoms by the Jainas. Javeri and Munishri[27] call these basic atoms as forms of energy. This concept may not be valid in these days of relativity when all forms of energies are also supposed to possess mass, howsoever small it may be. In olden days, it was just impossible to feel even for such an infinitesimal mass. It is even today imperceptible by senses and instruments. The atoms are, therefore, basically said to be *aguru-laghu*[28] (neither-heavy nor-light) rather than massless. Radhakrishnan seems to be partially right when he points out Jaina atom to possess weight. In fact, this word or quality shows the limitations of reason and thoughts on this point. By this, the two terms — *rūpī* and *aguru-laghu* should

be taken as complementary rather than contradictory.

Besides indicating the four qualities, the word *'rūpī'* also indicates about the shape and size. Though each system points out atoms to be of solid spherical point shape, the Vaiśeṣikas and Jainas have estimated their sizes to be between 10^{-4} to 10^{-13} cm. It could be guessed that this point alone can not make Jainistic atom to be different from the contemporary atom.

Despite the space point, shape and size, Jainas postulate quality of contraction and expansion capacity in atoms. This could be possible only when atom is supposed to be sufficiently hollow. No other older system has assumed this property in atoms. This hollowness, however, has been proved by the scientists of this century. But how a space-point could be hollow for the Jainas ?

Atoms are supposed to be real and their existence is proved by their activity and effects like formation of molecules and gross matter. It is the fourth variety of mattergy. It has indefinite activity and different types of motion and velocity. It has bonding capacity of a high order. Munishri[29] and Ramapuria[30] have summarised different properties of atoms described in canons. This indicates that the Jainas have pointed out many qualitative and quantitative properties which could be classified and described under the following four heads :

(i) Dynamic properties
(ii) Law of conservation of mattergy
(iii) Bonding properties
(iv) Variety of atoms.

The substantial, spatial, timal and modal description of atoms include all these properties.

Dynamic Properties

All systems assume dynamism in atoms. While the first motion in atoms is assumed to be due to vital force called *adṛṣṭa* by the Vaiśeṣikas, the Greeks assume it to be natural,

linear and colliding one. However, no details are specified by them. In contrast, the Jainas have given better and finer details about their dynamism. They presume the atoms to be static as well as dynamic. Their movements may be linear or complex, elastic or non-elastic, vibratory or otherwise[31]. It could be in different directions and it may or may not touch other atoms in their way. The cause of motion may be natural, external or both. The natural motion is, however, always irregular. When it is caused by external source like collision with other particles, it may have complex and non-linear motion. Normally, the motion is elastic, but there can be non-elastic motion also due to (i) absence of medium of motion, (ii) high velocity collision or (iii) bonding with other atoms[32]. Due to this, the atom looses its independence and free state of activity. The free atom has irregular motion only. The literature mentions seven types of motions – simple and complex vibration, linear or directional translation or transformation, collision and penetration and rotation[33]. The scientists have added only spinning motion in atoms in addition.

Besides motions, the Jainas have also mentioned the speeds of atoms. Their speed can vary from a minimum of one space point to the maximum of the end point of this spacy world or *lokākāśa* of 10^{27} cms. (as per Einstein) per unit instant time[34]. The Greeks and Vaiśeṣikas have not mentioned the atomic speeds at all. The scientists have, however, calculated normal atomic speeds to be of the order of 10^4-10^5 cms. per second[35]. It could, however, be increased or decreased enormously depending on various conditions. The Jainas have not suggested normal speeds of atoms per chance due to lack of measuring teachnics. But they seem to point out the limits of speed. The scientists are not in a position to substantiate the highest speed in view of their maximum speed of 10^{10} cms for light – so called massless mattergy of the Jainas. Despite current theories, it has still to be seen whether this could reach 10^{27} cms. The unit of time of Jainas is too small in comparison

to scientist's unit of second. The Jaina atom, thus, seems to be more ferrocious than the current one. Recently, A. K. Jain[36] has given a calculation for the atomic speed of 10^{17} cms. per unit of time assuming 1 *Prati-vipalāmśa* to be equal to 9000 secs. and the *'samaya'* unit of time to be innumerableth times smaller than this. Measurements upto 10^{-23} sec. have been made in laboratories now. Even if this is taken as equivalent to the *samaya* unit (which is not canonically correct), still the speed passes 10^{17} cms. mark. Munishri's[37] calculations still seem to be imaginary, though mathematical.

Law of Conservation of Mattergy

The term 'mattergy' includes the current matter and energy. The postulate of eternal nature, indestructibility and beginninglessness of mattergy naturally lead to their conservation law. It was Lomonsoff who first described law of mass conservation in 1774 and the combined law of conservation of mass and energy came into existence after Einstein's theory in early twentieth century. Thus, this concept existed long before in Indian system except Buddhists. The Greeks and Vaiśeṣikas also agree to the eternal nature of atoms and, thus, conservation law is seeded in all the three systems. It must be noted, however, that the atoms could change modally under different conditions or causes without loosing their substantivity.

Bonding between Atoms

The bonding between atoms convert them into molecular or new forms. The bonding is due to non-elastic collisions according to the Greeks and it is due to vital force for the Vaiśeṣikas. The latter have, however, thought of gross transformation and suggested that despite initial vital force, the visible changes in forms can be specified through the heating process which either dissociates the gross matter first into active atoms rearranging themselves later into new forms or the heat energy enters into the gross matter whose atoms undergo transformations directly without dissociations[38]. This means that che-

mical changes can be brought about by heating or supplying the necessary energy for them. The conversion of raw pot into baked pot by fire in five to eleven instants is their popular example. In current language, it means that the chemical changes take place by the mixed process of association and dissociation through thermal energy, the only form of energy known at that period. Of course, one now knows that there are many complex chemical reactions taking place during the baking process.

The Jainas have also thought on this problem. They have pointed out that new forms are made by simple association, dissociation and a mixed process. It has also been pointed out that visible molecules are formed by mixed process. Some scholars have used fission and fusion terms for these processes. This does not seem to be correct because of their high energy requirements. These processes are a later development in Jaina atomic theory during Kundakunda age. Previously, *Bhagavatī*[39] mentions that bonding could take place due to the presence of some glue or sticky substance (*sineha*) which makes it possible to contact the binding atoms intimately. The word *'sineha'* has been shown to have many meanings. Per chance, it could be precursor to the properties of roughness and smoothness not found in canons jointly. It is said that two atoms do not combine in this way but more than two atoms do combine.

Kundakunda[40] and Umāsvāti[41] have gone deeper into this problem and have made great advance over the canonical age concepts. They have postulated some fundamental rules for governing atomic combinations based on their electrical nature as pointed out by Pūjyapāda[42]. Accordingly, all atoms have quantitatively and qualitatively differing electrical nature of smoothness and roughness akin to current positive and negative charges. Their combinations take place due to non-elastic (counter-blowing) and high velocity collisions. Atoms always combine totally leading to chemical change. Atoms do

so either partially or totally with molecules leading to physical changes also. The total combination may be caused due to natural or external causes like presence of catalysts and other physical factors.

The real cause of total combination is the electrical nature of atoms. It is of two types. *Ṣaṭkhaṇḍāgama* (*Vargaṇā* Section)[43], Kundakunda, Umāsvāti and later scholars have given four basic rules for atomic combinations. They are given in a co-ordinated form as there seems to be some difference between various versions :

(a) The atomic combination takes place between the atoms of opposite electrical nature. The natures are quantitative as well as qualitative. The electrical charges are always in integral number.

(b) However, no combination can occur between atoms with lowest level electrical nature, i. e. 0 or 1. In early period, zero was not taken as a number, it seems. But, if the charge of one of the atoms is differing, the combination may occur (i. e., inert gas compounds of today).

(c) Under some circumstances, the atoms with quantitatively similar nature can also combine. Atoms having quantitatively similar but opposite nature can also combine. The formation of hydrogen molecule and sodium hydride are the current examples :

$$H^{\cdot} + H^{-} = H_2 \quad : : \quad C^{+} + 4H^{+} = CH_4$$
$$Na^{+} + H^{-} = NaH$$

This rule is given here in positive rather than negative form following Amṛitcandra Sūri[44]. The earlier scholars did not take it that way and have to face large number of problems leaving them unexplained. Those who equate Jaina atom with electrons or positrons, are also not in a position to explain the formation of heavy electron or proton on the basis of negation of this type of bond. Firstly, these combinations require huge amount of energy not commonly available. Secondly, they have

to take shelter of force of attraction at nearest approach causing the particles oppositely charged. But there too, the charges are similar but opposite. This leads to explain this law in a very conforming way to meet the real situation.

(d) Those atoms do combine which have similar or dissimilar charges differing by two or more than two units (according to one view, similar charged only). Though the literature does not cite examples for this rule but formation of hydrogen peroxide and sulphuric acid prove this rule. Some scholars prefer difference in charges by a minimum of two units only, while others prefer otherwise.

It seems that *Ṣaṭkhaṇḍāgama* rules for bonding are more liberal and realistic than Kundakunda and Umāsvāti. The Śvetāmbara version seems to be still more liberal. These rules are tabulated in Table 3, where current bond theory is also shown. One can evaluate the canonical variations as well as current opinion.

Table 3 : Jaina Rules for Atomic Bonding.

Quantitative Electrical Nature (X=0 or 1, Lowest)	Similar Nature			Dissimilar Nature			Current science
	S	D	Sv	S	D	Sv	
A (1) X + X	N	N	N	N	N	N	N
(2) X + (X + 1)	N	N	N	N	N	N	Y
(3) X + (X + 2) etc	N	N	N	N	N	N	Y
B (1) (X + 1)+(X + 1)	N	N	Y	Y	N	Y	Y
(2) (X + 1)+(X + 2)	N	N	N	Y	N	Y	Y
C (1) (X + 1)+(X + 3)	Y	Y	Y	Y	Y	Y	Y
(2) (X + 1)+(X + 4)etc	Y	X	Y	Y	N	Y	Y

Sv = *Ṣaṭkhaṇḍāgama Vargaṇā Kāṇḍa,* SS, p. 230.
N = No bond, Y = Bonding, S = Śvetambaras, D = Digambaras.

It is said that during bonding, basic atoms do not change but they merely associate with other atoms to have

different forms. The nature of newly formed combination may be either neutral or similar to the combining atom having higher electrical qualities. Many examples like formation of sodium *chloride (neutral), sodium hydroxide (basic) and ferric chloride* (acidic) can be given to support this assumption.

There is a remarkable qualitative similarity of these rules with modern chemical bonding concepts. The chemists tell us three types of bonding — electro-valent, co-valent and co-ordinate valant, whose definitions are nearly akin to the rules above (though modified or co-ordinated). Similarly, there are four methods of molecular formations where the mixed process of association and dissociation may be equated to displacement methods of today[45]. Neither the Greeks nor the Vaiśeṣikas have given so much details about bonding in atoms. Ray[46] and Subbarayappa[47] have described the latter system without much comparative evaluation. However, they seem to agree that Indian atomism developed through Sāṅkhya, Vaiśeṣikas and the Jainas. These authors may be right in analysing in non-impactiveness of these thoughts.

The bonding theory of Jainas goes far ahead of Berzelius hypothesis as it is more quantitative. The chemists could give answers to many points in this regard only by early quarter of twentieth century. The current views may partially vary with the canonical concepts which is quite reasonable.

Variety of Atoms

The Greeks have postulated innumerable variety of atoms of different shapes and sizes. They are, however, devoid of four qualities though they are felt because of our sensuous experience. They have property of touch. Vaiśeṣikas, on the other hand, postulated four kinds of atoms – earth, fire, water, air – with different properties of touch, taste, smell and colour. As against this, the Jainas have manifold variations from many angles. They used the physical properties for their classification besides other bases. However, a large number of their classifications are only conceptual. *Anuyogadvāra*[48] mentions two

types of atoms – (i) fine and (ii) real or phenomenal. They have also been called as effect atom (fine) and (ii) causal atom (real). Absolute and phenomenal atoms are also described having similar meaning. In quite a number of descriptions, it is the real atom which consists of infinite number of fine atoms. A large number of properties canonically described refer to real atoms rather than fine atoms. This classification seems to have developed when there seemed unsurmountable difficulties in the concept of all *paramāṇus* being assumed of the same type and forming a single class. This concept has not stood the scrutiny with times as shown earlier.

The atoms have also been classified in four aspective types[49] – substantial, spatial, timal and modal. Almost all early literature refers to these types. The physical quality based classification consists of two hundred varieties of atoms. Their number could be estimated by assuming combinational aspects of 2 smells, 5 tastes, 5 colours and 4 touches (out of 4 opposing pairs), thus forming $2 \times 5 \times 5 \times 4 = 200$ varieties of atoms. If intensities of these qualities are also taken into account, infinite types of atoms may be thought of. *Bhagavatī*[50] mentions 16 varieties of atom on the basis of four qualities which have grown to 200 later, it seems.

The current science also takes physical properties like atomic weight or number into account for atomic classification. Accordingly, they have 109 types of atoms at present with further chances of discovering and synthesizing newer ones. One is not in a position to judge which method of classification based on perceptible or measurable properties is better. But credence must be given to measurable properties. However, credit must be given to the Jainas in using physical properties for their classification, thus, excelling in this regard over the contemporary philosophies.

Conclusion

The above description makes it clear that the atomic theory developed by the Jainas has many qualitative and quan-

titative aspects worthy of note. The history of science could not be complete without taking them into account alongwith other Indian systems[51].

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30. Bhīkhanjī : *Nava-padārtha,* p. 100.
31. *Bhagavatī-sūtra,* p. 864.
32. *Ṭhāṇam,* p. 251.
33. *Bhagavatī-sūtra,* p. 3247.
34. Muni, Mahendrakumar II : In *S. C. D. Felicitation Volume,* pp. 4-5.
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36. A. K. Jain : In *Tulasī Prajñā,* Jaina Vishvabharati, Ladnun, 12.1, 1986, p. 74.
37. Muni, Mahendrakumar II : In *S. C. D. Felicitation Volume,* pp. 4-7.
38. Shankara Mishra : *Vaiśeṣika-sūtra-upaskāra,* p. 371.
39. K. C. Lalwani : *Bhagavatī-Sūtra*-1 (English Translation), pp. 139-142.
40. Kundakunda : *Pravacana-sāra,* pp. 207-209.
41. Umāsvāmi : *Tattvārtha-Sūtra,* Varni Granthamala, Kashi, 1970, p. 108.
42. Pūjyapāda : *Sarvārtha-siddhi,* Bharatiya Jnanapitha, Delhi, 1971, p. 219.
43. Ācārya, Puṣpadanta & Bhūtabali : *Ṣaṭkhaṇḍāgama,* Book 14, pp. 30-32.
44. Amṛitacandra Sūri : *Tattvārtha-sāra,* Varni Granthamala, Kashi, 1970, p. 108.
45. N. L. Jain : *Griha Vijñāna Rasāyana,* Ram Prasad & Sons, Agra, 1985, pp. 32-33.
46. P. Ray : Indian Journal of History of Science, 1.1.1966.
47. B. V. Subbarayappa : *Ibid*, p. 19.
48. *Anuyogadvāra-sūtra*, A. P. S., Beawar, 1987, p. 250.
49. *Bhagavatī-sūtra,* p.2885.
50. *Ibid,* p. 2846.
51. *Post-script* : *Arhat Vacana,* 1995 postulates a new meaning to the Jaina Theory of Bonding indicating that aphorismic meaning of bonding due to 'snigdha and rukṣa' should mean three types of bondings — (i) *Snigdha – Snigdha,* (ii) *Rukṣa – Rukṣa* and (iii) *Snigdha – Rukṣa.* This does not seem to be right as there is only singular number in the aphorism. This will also have repercussions on the following aphorisms in this regard. Secondly, one is also not right to say that bondings specified in literature refer only to electrovalent linkage.

Section Three

Physics Section

Physics deals with general properties and forces associated with gross and fine matter. It also deals with various natural energies like heat, electricity, sound, light, etc. Where do these energies arise in substance ? What is the nature and function of these energies ? Can we utilise them for more useful purposes ? These and many other questions encourage the scholars to study them in a fundamental way. There has been keen curiosity about them in non-experimental canonical periods. Like other Indian philosophies, Jaina canons and later philosophical literature contains many related phenomena about them. The canonical period varies between a few centuries B. C. to about 10th century A. D. This chapter is an attempt to collect and estimate these contents with reference to current knowledge.

The general properties have already been described under Chemistry section. As the sciences depend for their crediblity upon weights and measures, it will be attempted first. This will be followed by descriptions about various energies in canons.

This section contains four chapters concerning :

(i) Weights and Measures-1 : Mass and Volume Units

(ii) Weights and Measures-2 : Length and Time Units

(iii) Contents of Physics-1 : Heat and Light

(iv) Contents of Physics-2 : Sound, Electricity and Magnetism.

Chapter 8

Weights and Measures-1 : Mass and Volume Units

Jainological texts belong to two categories – (a) purely religious with the basic thesis of moral and ethical values and (b) semi-religious which have other aspects along with that of the first category. The earliest canons belonged preferably to the first category. It is difficult to tell as to how and when this category took the new shape of the second one. The first category is represented by *Ācārāṅga, Daśavaikālika, Kunda-kunda* literature and others while the second category is represented by Umāsvāti, Āryarakṣita and others. It could be surmised that the second category must have developed later than the first one when sufficient knowledge about the physical world and events must have been obtained in a form to be given to common man. This knowledge is sensory in the first instance which is analysed by mind to give proper form and explanation. Barring super-sensory knowledge, all other forms are primarily relative and qualitative. This has to be expressed in a reliable and accurate form. And what else could be more accurate method than the mathematical or quantitative representation ? This could be done only when there is a firm basis of standardised units of weights, length and time. This gives reliability and credibility to descriptions.

The Jainācāryas realised this fact. That is why they have written many special and general treatises in this direction during different periods. It is somewhat later periods that the quantitative nature of many descriptions got diversified and the scientific mind of today has something to say for or against it. Nevertheless, the Jainas seem to be quite finely advanced

when they consider the numbers to the tune of 10^{-190} to 10^{250} as normal and put up the ideas of numerables, in-numerables and infinites in respect of many types of descriptions of the universe.

Areas of Measurement

Jñātādharma-Kathā[1] mentions four types of measurable materials for trade and commerce :

(i) Numerally countable (*Ganim* : coins, fruits etc.)

(ii) Weightable (*Dharim* : grains and minor things like sugar etc.)

(iii) Measurable (*Meya* : measured in terms of Volume, preferably liquids)

(iv) Estimatable (*Parichhedya* : measured in length units).

These involve two types of measures – (a) weights and volumes and (b) length. This has also been expressed in another terminology in *Bhagavatī* and other didactic canons. They have used three words while describing about kings and richmen regarding height, weight and volume of the body. They are *Māna* (*Meya*), *Unmāna* (weightable) and *Pramāṇa* (height or length)[2]. *Sthānāṅga*[3] also mentions the units of *Bhara* and *Kumbha* for gems and a term *avamāna* with *Unmāna* (whose meaning of volume measure seems to be more reasonable) without definition. *Antakṛtadaśā*[4] mentions about an iron hammer of a demon weighing 1000 *palas* and *Upāsakadaśa* tells us about donations of a king limited to two *Droṇala* measures and *Kārṣāpaṇa* value of medicated oils[5]. *Anuyogadvāra* and *Trilokasārā* define these units and give their details[6]. Time measures are also found in different canons[7]. Thus, there have been three major areas of measurements during the canonical or post-canonical periods :

(i) Mass and volume

(ii) Length, distance, area and volume

(iii) Time

In contrast, the International Congress on Weights and Measures, 1971 has accepted seven areas under this category as shown in Table 1 with their units of measure[8].

Table 1 : Canonical and Current Units of Measures.

Measure	Canonical Name	Canonical Units	Sc. Units
1. Mass	*Dravyamāna*	Practical atom, *Kārṣa, pala, tulā* etc.	mg., gram, Kg.
2. Distance	*Kṣetramāna*	Space point, *Aṅgula*	mm., Centi-meter, metre
3. Time	*Kālamāna*	*Samaya, Āvalī, Prāṇa*	Second
4. Electric current	—	—	ampere, volt
5. Heat	—	—	Calorie, Kelvin
6. Light	—	—	Candela, Lux
7. Matter	—	—	Mole
8. Abstract quality (Not approved by I. C. W. M.) : No Units in Canons too.			

It could be surmised that the four to seven categories of measures could not develop during canonical times. Of course, one finds mention of heat (*tāpa*), light (*prakāśa*) and electricity (*vidyut*) in canons in their various aspects.

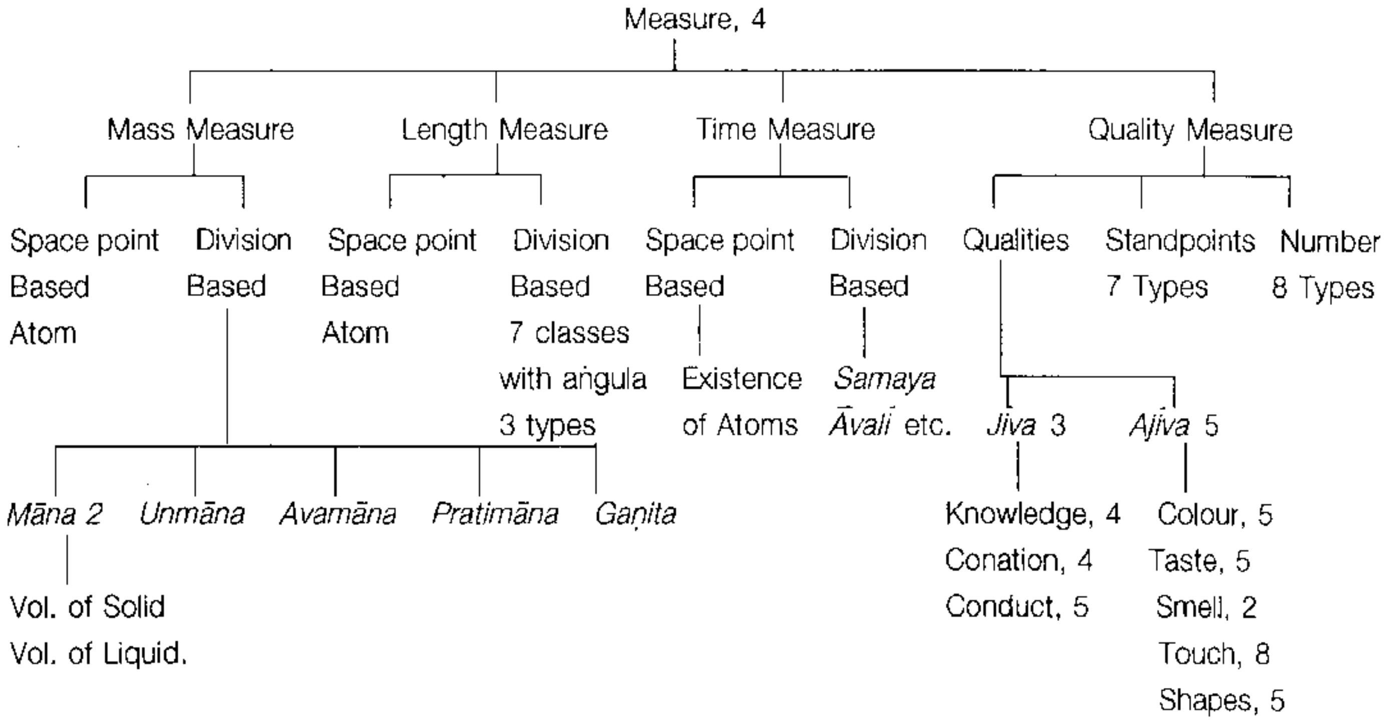
Concept of Measures in Jaina Canons and Pro-canons

The Jaina descriptions on measures date back from many centuries of pre-Christian and post-Christian era. On closely going through them, one finds two traditions developing, per chance, side by side with a large amount of diversity in quantitative values in the units and their current equivalents. This is the case with all types of measures. These difference may refer to *Mathuri* or *Valabhī* Councils or South-north regions. Of course, the basic fundamental unit of space point or atom is an exception where there seems to be no difference. Quite

a good number of higher values seem to be mythological rather than scientifically logical. They represent the changing concepts and ideas in different ages when standardisation was not the practice. This seems to be more surprising that despite the fact of scholars regarding the origin of decimal system in the east, no attempt seems to be there to adopt it in measure-system. This has resulted in large number of statements not seemingly credible. This author wishes to attempt to collect and present them to suggest modestly, with proper analysis, the need for their uniformity and standardisation so that the descriptions made on their basis may become consistent, coherent and better credible. It is worthwhile to note that many modifications in definitions, concepts and details have been taking place throughout the canonical and commentators' periods to make them more accurate and generalised[9]. This attempt is meant for encouraging this attitude in current times.

Jaina texts have coined the term *'Pramāṇa'* and *'Māna'* (T. S.) for the process of measurements of length, time, weights and volumes. They are contained in *Bhagavatī* (B), *Sthānāṅga* (Sth.), *Anuyogadvāra Sūtra* (A. D. S.), *Triloka Prajñapti* (T. P.), *Taṇḍulaveyalīya* (T. V.), *Rājavārttika* (R. V.), *Dhavalā* (D), *Jambūdvīpaprajñapti* (J. D. P.), *Trilokasāra* (Ts.) and in some other canons in stray form as shown in Table 2. However, it must be pointed out that there are more descriptions about length and time units than weights and volume units of matter. It is also observed that R. V. and Ts. follow different ways of classification of measures from the other canons[10]. This matter seems to be a later development. Despite the fact that there is not much difference in different initial units of weights and measures, these sources classify the measurements in worldly and para-worldly varieties like the Jaina scriptures in A. D. S. and Nandī[11]. The first variety of worldly measure is mainly concerned with weights, volumes, cost, numeration and has six classes instead of five in A. D. S. where these are included in mass measures only[12]. Though

Table 2 : A. D. S. Classification of Measures.



A. D. S. and R. V. seem to include the length measure through the variety of *'Ava-māna'*, but Ts. has described it as a measure of small volumes. This seems to be more reasonable in view of the *Dravyamāna* descriptions.

A second difference is also discernible concerning the nature of units of different measures. There are two types of units — (i) Fundamental (atom or space point based) and (ii) Derived or division based. A. D. S. has both types of units for weights, distance and time while R. V. and Ts. has this case for length units only. These units are meant for visible or tangible mass.

Thirdly, in contrast with A. D. S., the R. V. and Ts. do not include time units in their worldly measures which A. D. S. and D have in their general measures. There is also a difference between mass measure and abstract measures in these texts as in A. D. S.

Sthānāṅga[13] and A. D. S. classify the different measures in four basic classes (Table 3) :

(i) *Dravyamāna* (matter and mass)

(ii) *Kṣetramāna* (length in all respects)

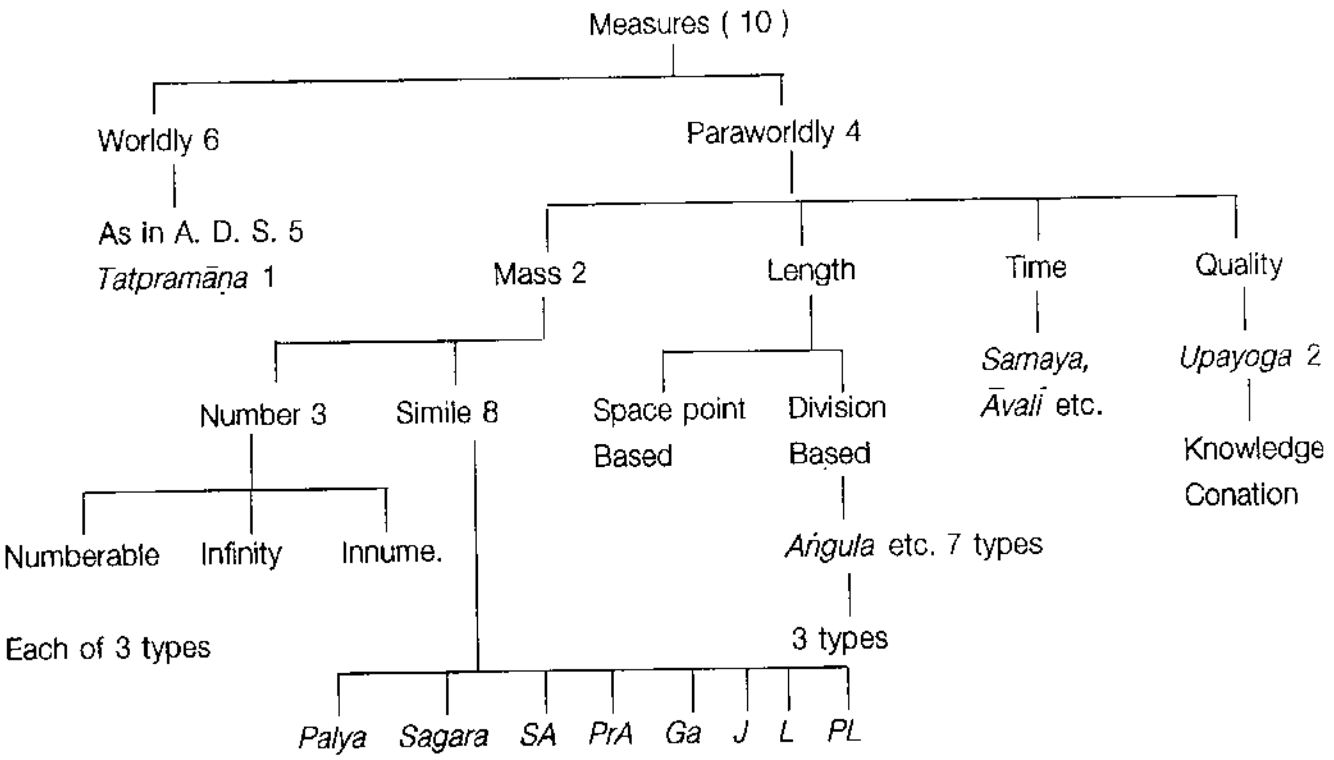
(iii) *Kāla-māna* (Time measure)

(iv) *Bhāva-māna* (Abstract measure)

(v) *Naya-māna* (Standpoint measure) — special in *Dhavalā*[14].

The mass measure gives us weight and volume of solids and liquids from the smallest atom to the largest earth. The length units measure the distance, area and volume from one space point to the last of the world space. Time units measure from one *'samaya'* unit of time upto infinite time units. The abstract measure gives us an idea of quality of faith, conation and standpoints. All these four general measures of A. D. S. are covered by the four para-worldly types R. V. and Ts. In contrast, the *Ṣaṭkhaṇḍāgama* has five types of measures separating standpoint type from abstract measure of A. D. S.

Table 3 : Akalanka Classification of Measures.



and adding this to R. V. measures which did not include it in their abstract measure.

The para-worldly nature of these measures seems to be the creation of Akalaṅka of eighth century who has many such credits. It is also observed that para-worldly mass measure of Akalaṅka has been differently classified from the A. D. S. mass measure. The authors of B, T. P., J. D. P. do not propound any para-worldly measures. Of course, *Bhagavatī* has countable and simile time[15].

The A. D. S. has three main classes of Abstract measure-conation, quality (of living and non-living) and standpoint with many sub-classes thereupon. *Bhagavatī* does not have these types. Akalaṅka has given only five types of knowledges (with no conation or its varieties) in his explanatory commentary. Table 2 and 3 summarise the A. D. S. and R. V. measures. It seems that A. D. S. classification is more logical and avoids repeatition and confusion than R. V. Table 4 summarises the useful information about the different measures.

This also makes it clear that no dividing line could be drawn between worldly and para-worldly measures as the latter includes six varieties of worldly type. Of course, it seems that the latter type has more extensive area of measure to cover length, time and qualities. If we define this measure as that which has measuring limits beyond the grossness and fineness of worldly measures which may be invisible or unholdable, still the numerable measures of matter, the varieties of *Aṅgula* (A) etc. of length and *Muhūrta,* day etc. units of time can never be called para-worldly. In addition, Akalaṅka has divided mass measure in two varieties – number and simile measures which could be included in countable measures as in A. D. S. The simile measure has eight varieties, out of which *palya* and *sagara* are definitely time units and the rest six are length units. The simile measure, therefore, could not be taken as a subclass of matter measure of para-worldly type. Of course, it would be a different case if one assumes them to be matter units as

they are closely related with matter. In view of these discrepant facts, Akalaṅka's first stage classification of measures, thus, seems to be superfluous and could be overlooked at present. The abstract number measure of A. D. S. has taken care of the above two measures of Akalaṅka. A serious reconsideration on this first stage Aklaṅka's classification is necessary to avoid non-uniformity.

We will describe the three canonical measure units in order of (i) weights and volume of solids and liquids (ii) length, area and volume and (iii) time.

Measurement Units of Weights and Volumes of Matter

Stray references to specific weights and measures are found in many canons. But the first systematic treatment is given only in A. D. S.[16]. The A. D. S. has given first five types of matter measures as shown in Table 4. One could see that they could be reduced to three only as no weighing (*Unmāna*) could be done without standard or model weights (*Pratimāna*) and hence two should form one category. Secondly, *Avamāna* may be included in *Māna* as it should represent smaller volume measures according to *Trilokasāra*. The addition of comparative cost measure of *Tat-pramāṇa* by Akalaṅka seems to be empirical but adds to the measurement areas. All these are described below.

It is learnt from canonical stories that not only solids and liquids, but coins were also measured through bronze vases or pots of specific sizes which actually measured volumes rather than weight. This practice is still observed in case of rich people in rural India. It seems easier and less time taking than counting in numbers.

The canons tell us that there were different types of measures for solids and liquids of different values. Precious metal measures were still different from and smaller than general measures. The volume measures are termed as *'Māna'* or *'Meya'*.

Table 4 : Useful Informations About Different Measures.

[A] Matter Measure, *Dravyapramāṇa* (A. D. S.) or Worldly Measures (RV)

No.	Name	Definition	Units	Uses
1.	*Pratimāna*	Model/standard measures	*Guñjā, Kākinī,* Myrtle seed, *Suvarṇa*	Weight of gold, silver, pearls, minerals etc.
2.	*Māna*	Volume measures		
		Solids	*Guñjā, māṣa, Prastha* etc.	Vol. of solid/ liquids in large containers
		Liquids	*Ṣoḍaṣika, Mānī* etc.	
3.	*Avamāna*	Small volume measures	,, ,, ,,	Water in handcup
4.	*Unmāna*	Weight measures by balance	*Pala, Tulā, Bhara, Karṣa* etc.	Weight of medicines, sugar, jaggery etc.
5.	*Gaṇana Māna*	Countable measures	1, 2, 3 etc.	Wages, foods, fruits, coins, accounting
6.	*Tat-pramāṇa*	Comparative costing	—	Halo of gems, Height of horses

[B] General Measures (A. D. S.) or Paraworldly Measures (R. V.)

No. Name	Definition	Units	Uses
1. *Dravyamāna* (Abstract measure,	Matter/Volume measure (a) Number Measure (b) Simile measure	Finite, infinite numbers	Ages of living beings etc.
2. *Kṣetramāna*	Length, area, volume. measure	*Angula* etc.	Distances, Height, Volume of Universe/parts
3. *Kāla Māna*	Time measure	*Āvalī, Prāṇa, Muhūrta* etc.	Time & duration etc.
4. *Bhāvamāna*	Abstract Measures, Qualities, Standpooints, Number (A. D. S.)	—	Measures/count intensity of qualities

It is pointed out that there were two prominent types of such measures current in early periods – (i) Magadhan measures and (ii) Kaliṅgan measures. The first ones were more popular and Jaina canons have followed them. The Kaliṅgan measures had somewhat smaller values for their unit of *Karṣa* (= 1 *tolā*, 0.83 of Magadhan value) in the end. These measures are found in Āyurvedic texts also. Vāgbhaṭa co-ordinated these measures later but canons have only Magadhan measures[17].

(a) Māna and Avamāna

The measures of *Māna* and *Avamāna* seem to be the most important in canonical periods. Both of them measure volumes. However, volumes and weights have been related at some stage so that one could express one measure into another measure without involving the concept of density.

The A. D. S. describes *'Māna'* into two classes — (i) grains measure or measure of solids and (ii) fluid or liquid measure. It is said that the tip of the grains measure is pointed upwards while it is pointed downwards in case of liquids. This is an observation pointing out the quality of surface tension in liquids indirectly.

The first unit of grains measure is *'Asati'* - an equivalent of *'Pala'* unit of Magadhan system according to Apte[18]. Table 5 gives comparative details of solid measures in different systems. Table 6 indicates that though these measures follow basically Magadhan system, the quantitative nature of practical units seems to be different in many sects. The A. D. S. values are highest and nearly double the Magadhan ones and R. V. values are smallest in comparison. They are dependent on the relationship between *'pala'* and *'Kudava'* units which are varying in different system. The T. V.[19] has given two types of units-- one the same as A. D. S. and the other one as different from A. D. S. One of the two seems to be an interpolation as it does not seem to be coherent when the value of *'Prastha'* is calcu-

Table 5 : Māna or Volume Measures of Solid Substances**.

	Magadhan Measures	Kalingans	Bagbhatan	A. D. S	R. V.	T. V.	R. S.
1.	30 Atoms = 1 *Trasremu*, T	T	6 Atoms=1 T	–	–	–	
2.	6 T = 1 *Marichi*, Mi	Mi	–	–	–	–	
3.	6 Mi = 1 *Rai*, R	R	–	–	–	–	
4.	3 R = 1 *Sarṣapa*, S	S	1296 T = 1 S	–	–	–	
5.	8 S = 1 *Yava*, Y	–	6 S = 1 Y	–	–	–	6 S = 1Y
6.	4 Y = 1 *Guñjā*, G	–	6 Y = 1 G	–	–	–	6 Y = 1 G
7.	6 G = 1 *Māṣā*, M	–	6 G = 1 M	–	2G=1WM	5G=1M	6 G = 1 M
8.	192 S = 1 M	M	216 S = 1 M	–	16WM=1 *Dharana*	–	12M= tolā,t
9.	4M = 1 *Shan*, Sh	Sh	4 M = 1 Niṣka, N	–	2.5 Dh=1 Suvarna, Sk	–	4t=1P
10.	16M = 1 *Karṣa*, K	10M = 1K	4N = 16M=1K	–	–	16M=1K	–
11.	4 K = 1 *Pala*, P	P	P	–	4SK=1P	4K=1P	–
12.	4P = 1 *Kudav*, Kd.	Kd	Kd	4 Asati,P= 1Setika,Se	–	4P=1 Se	–
13.	–	–	–	4 Se = 1Kd	$3\frac{1}{8}$ p = 1Kd	4 Se = 1 Kd	–

Magadhan Measures	Kalingans	Bagbhatan	A. D. S	R. V.	T. V.	R. S.
14. Kd = 1 *Prastha,* Pr	Pr	Pr	Pr	Pr	Pr=12.5P	–
15. 4 Pr = 1 *Āḍhaka,* A	A	A	A	A	A	–
16. 4 A = 1 *Droṇa,* D	D	D	D	D	–	–
17. 4 D = 1 Dr	–	–	–	–	–	–
18. 4 Dr = 16D = 1 *Khari,* Kh	Kh	–	–	Kh	–	–
19. 100 P = 1 *Tula,* T	T	T	–	T	–	–
20. 2000 P = 1 *Bhara,* B	B	B = 4000 P	–	–	–	–
21. –	–	–	100A = L. *Kumbha*	–	-	–
22. –	–	–	800A = 1 Vah, V	20Kh=1V	800A=1V	–
23. –	–	–	–	–	22.5 V=576 Q	

** Q = Quintal, 100 Kg. : 20 Kh (in R. V.) = 320 D = 1280 A : 22.5 V = 100 Years feed (T. V.)

Some intermediate steps have been omitted in this table. Where there is only symbol of measure, it should be taken as equal to base in front. R. S. = *Ratna-samuccaya.*

Table 6. Values of Same-named Measures in Different Sources

No. Unit	Equivalent in						Most probable
	Magadha	Kalinga	A. D. S.	R. V.	T. V.	R. S.	Current value
1. *Karśa,* K (*Tolā,* t)	16M, 96G	10M, 80G	–	16M, 80G	16M, 80G	72G	11.6 g
2. *Pala,* P	384 G	320 G	–	320 G	320 G	288 G	46.40 g
3. *Māsā,* M	6 G	8 G	–	–	5 G	6 G	1.44 g
4. *Kudava,* Kd	4 P	4 P	16 P	3.125 P	16 P	–	185.60 g
5. *Prastha,* Pr	16 P	16 P	64 P	12.5 P	12.5 P	–	0.80 Kg
6. *Āḍhaka,* A	64 P	64 P	256 P	50 P	50 P	–	3.20 Kg
7. *Khāri,* Kh	4096 P	3200 P	–	3200 P	–	–	–
8. *Vāh,* V	–	–	800 A	1280 A	800 A	–	2.6 Quintal

lated. It turns out to be 12.5 and 64 respectively. This non-coherence requires clarification from the canonists.

As far as the current literature goes, no author seems to have made out this disturbing point for the advancing knowledge. For example, Sādhvī Divyaprabhā refers to *Śārṅgadhara Saṃhitā* for another unit equations as given below :

(i) 10 M = 1 Kd 14.4 g

(ii) 2 Kd = 1 Pr = 4 *tolā* = 46.40 g (P. S. M.)

(iii) 1000 Pr = Demonic iron hammer

This is in contrast with 4 Kd = Pr. This will give half the value for *pala.*

(b) Liquid measures

The canons begin their liquid measures with units four times larger than solid measures. The first unit is based on *'pala'* unit and is equal to four *'palas'* named as sixty-four-fold measure (*Catuṣṣaṣṭika*). Its last unit is *'Māni'* which is equal to 256 *palas.* The following Table 7 gives the details of its seven measures which have twice as much value as the preceding one on direct order. Similarly, the preceding ones have half the value when taken in reverse order.

Table 7 : Canonical Liquid Measures.

Canonical name	Unit	Value (measure)	Relation	Current Value
1. *Catuṣṣaṣṭika*	4 palas	64-fold	C	46.40 ml
2. *Dvātriṁśikā*	8 palas	32-fold	Twice	92.80 ml
3. *Śoḍaṣikā*	16 palas	16-fold	Twice	185.60 ml
4. *Aṣṭabhāgikā*	32 palas	8-fold	Twice	371.20 ml
5. *Caturbhāgikā*	64 palas	4-fold	Twice	742.40 ml
6. *Ardha-māṇi*	128 palas	2-fold	Twice	1484.80 ml
7. *Māni*	256 palas	Māni	Twice	2969.60 ml

These volume measures make it important to learn about the value of *'pala'* unit in terms of weight units. These are described under *'Unmāna'* and *'Pratimāna'*. *Rājavārttika* defines the liquid measures with example of *Ṣoḍaśikā* etc.

without much details indicating it follows the tradition. However, if *'pala'* is taken as equal to 46.40 g., the *'māni'* unit of volume will weigh about 3 Kg. This seems to be too small a measure for volume specially in comparison of today's water tanks and Industrial tanks.

(c) Avamāna : Volume Measure or Length Measure

A. D. S. and R. V. define this unit as a measure of length and area through the units of *Daṇḍa, Hasta,* etc. In contrast, Ts. mentions it as volume measure of small amount of liquids just like water in hollow hand cup. This seems to be comparatively correct in analogy to the *Pratimāna* (Model) variety which also weighs small amounts of precious metals and materials. Though no units of *'Avamāna'* variety are given in Ts., still one could assume them as smaller than 64-fold measure. This first measure seems to be too big (equivalent to 46.40 ml. of today) for measuring costly liquids like Mercury or medicated oils where very small quantities have to be measured off and on. Normally, the term *'Avamāna'* also means small measures.

Secondly, if *Pramāṇa* means measures, the five or six varieties should also include time as it is also measured empirically. Moreover, measure of length and area is included in paraworldly category of Akalaṅka. *Bhagavatī* also mentions length units during descriptions of simile time measures. A. D. S. has also length measures as one of the four basic measures. Thus, it does not require repeatition under matter measure.

(d) Unmāna and Pratimāna (Model) measures of weights

As today, there were many materials in olden days which were sold or used by weights. The *Māna* and *Pratimāna* measures refer to weights. They were estimated with the help of balance on the basis of standard or model weights. Medicines, sugar, jaggery, candy, precious metals and the like are weightable materials. They could be in gross and fine forms. The units used in case of weight measures start from half *Karṣa*

and end in *'Bhāra'* unit. The total number of weight units are eight. Here also, each following unit is twice the preceding unit upto *'pala'*. There is difference of opinion about the value of *'Tulā'* unit in terms of *'pala'* the two values differ roughly by a factor of five as shown in Table 8.

Table 8 : Units of Weights in A. D. S. (*Pratimāna,* Model).

Units	Equivalence	Current Value, gm.
1. *Ardha-Karṣa* (Half-*Karṣa,* H. K.)	—	5.8 g.
2. *Karṣa,* K	2 H. K.	11.6 g.
3. *Ardha-Pala* (Half-*Pala*), H. P.	2 K	23.2 g.
4. *Pala,* P	2 H. P.	46.4 g.
5. *Ardha-Tulā* (Half-*Tulā*), H. T.	—	—
6. *Tulā,* T	105 P : 500 P	4872.00 g.
7. *Ardha-Bhara* (Half-*Bhara*), H. B.	10 T	48720.00 g.
8. *Bhara*	2 H. B. = 20 T	97,440.00 g. = 97.44 Kg.

However, Magadhan measure in R. V. has this unit as equal to 100 *Palas* which is supported by Āyurvedic texts. This should be taken as reasonable in comparison to higher value. Akalaṅka's volume measures may be equated to weight measures on this basis. Thus, with a *Karṣa* of 11.6 g., one starts with a minimum of 5.8 g. and ends at 97.44 kg (roughly a quintal of today). Modern weight unit start with about 580 times lesser weight (mg.) and ends with 10 times larger weight (1000 kg. = 1 ton) on the other side.

The standard weights or *Pratimāna* are said to be smaller ones to be used for weighting valuables like gold, silver, gems, pearls etc. These weights also start from *Guñjā,* G (or *Rattī*) and end in *Suvarṇa* (gold coin or *Sonaiya*). They are

given in Table 9 according to A. D. S. *Guñjā* becomes the base here. 96 G has been taken to be equal to weight of one gold coin prior to decimalisation of weights in India. Now as one gold coin is equal to one *'Tolā'* or roughly 11.6 g, one unit G = 11.6/96 = 0.121 g. On the basis of this value of G, one can find out the current equivalent of different canonical weights. However, it seems difficult to do so in view of Table 6 where *tolā* unit varies between 72-96 G. One has therefore to refer to some most common values given in literature and overlook others. For example, if G is taken as 0.121 g, the *Suvarṇa* coin will have a value of 9.68 g. which is sufficiently less than the weight of standard *'tolā'* (11.6 g) of today. This discrepancy has arisen as the value of *Karma-maṣaka* here is only 5 G rather than 6 G as in Table 5. Thus, these standard weights are discordant with earlier units. It should be *'sat-guñjāo'* in place of *'pañca guñjāo'* in A. D. S.[20]. This is a case of intra-contradictions in canon-like books. Many such examples have been cited on many topics by Shastri[21].

Table 9 : Model weights in A. D. S.

Units	Equivalence	Current Value
1. *Guñjā,* G	—	0.121 g
2. *Kākinī,* KK	1.25 G	0.151 g
3. *Niśpava,* Np	1.33 KK	0.200 g
4. *Karma-maṣaka,* KM	3 Np = 4KK = 5G	0.605 g
5. *Maṇḍalaka,* Md	12KM = 48 KK	7.260 g
6. *Suvarṇa* (Gold Coin)	16KM = 64 KK	9.68 g

It is, thus, seen that the weight and volume units mentioned in Jaina texts are smaller in value than the normal Magadhan values. They could have been based on 96 G = 1 K (*Karṣa*) in place of 80 G = 1 K so that proper comparisons could be made.

Secondly, it is observed that the Jainācāryas have not used their extraordinary interpolation and extrapolation technic

towards infinity on both-minimum and maximum sides of weight values as they have done in the case of length and time units described later. The canonists are the only ones authorised to explain this treatment towards units of weights and volumes.

On current reckoning, the canonical weight units seem to be sufficiently gross as they start with 0.121 or 5.8 g in comparison to 0.001 g in each case. They also do not have much on the maximum side too.

(e) Different Terms Used for Various Units

The Hindi commentators of canonical treatises have referred to different names of various units described above found in many books. For the sake of proper understanding, the different equivalent terms are given below :

1. *Ardhapala,* H. P.	*Śukti, Aṣṭamika*
2. *Āḍhaka,* A	*Bhajana, Kānsya-pātra,* 64 *palas*
3. *Dharaṇa,* Dh	*Śāna, Ṭaṅka*
4. *Droṇa,* D	*Kalaśa, Unmāna, Ghāta, Rāśi*
5. *Droṇī,* Dr	Vāho, *Goṇī*
6. *Karṣa,* K	*Paṇimāṇika, Ākāśa, Pich, Kiñcitpāṇi, Tinduka, Vidālpadaka, Ṣoḍaśikā, Suvarṇa, Udumbara* etc.
7. *Kole,* Kl	*Drankṣaṇa, Kṣūdraka, Vātaka*
8. *Kuḍava,* Kd	*Añjali, Ardhaśaravaka, Aṣṭamāna*
9. *Māṣa,* M	*Haem, Dhānuka*
10. *Maṇikā,* Mn	*Śarava, Aṣṭapala*
11. *Pala,* P	*Muṣṭi, Āmra, Caturthikā, Ṣodaśī, Vilva, Asati*
12. *Prastha,* Pr	64 *suvarṇa,* 64 *tolās* = 1 seer
13. *Śūrpa,* S	*Kumbha*

(f) Countable or Numeration Measures

In olden days, fruits, vegetables and many other things were sold by counts. This system still persists in an appreciable way in rural areas and partly in urban markets. However, it is

being replaced by weight measures in gradual practice. Besides, every measure requires knowledge of numbers as there can not be any unit without them. Hence, numeration serves two-fold purpose. A. D. S. mentions that this measure is useful for paying the wages to workers, purchasing foods and utilising proper amount of coins for purchases and accounts[22]. It goes to count the numbers upto a crore or ten million. However, it also mentions that numeration could be expressed in eight ways, out of which countable number is most useful as Muniśri also makes out[23]. Primarily, Akalaṅka does not mention numbers more than four as they are described under paraworldly measures in terms of (i) number and (ii) simile measures. Both, A. D. S. and Akalaṅka describe them in more detail which is given later in chapter on spatial or length units.

(g) Tat-pramāṇa Measure

No details are given in R. V. regarding this measure (measure of comparison) as it is too empirical for canonical days. However, some units could be found in current sciences under this category.

(h) Current Measures

Looking to the variety of measures in different parts of the country, the British tried to have uniform measures of weights overlooking the earlier ones. In the first instance, they were not based on decimal system but they represented simplification and co-ordination. Later on, they have also been converted to decimal system. The Āyurvedic system did not have specific volume units but there was a weight-volume conglomerate. Now because of density concept, the two units are separate. Table 10 summarises them and their details could be found in any physics book. The C. G. S. system is most current today.

With these new units in vogue, the canonical units have gone historical. Thus, the weights and measures have undergone change from irregular multiples to regularly decimalised.

They have also changed from a mixed nature to an identifiable nature in weights/volumes.

Table 10 : Current Units of Weights and Volume.

(a) British period	(b) Scientific units	Length	Volume
8 G = 1 M	Basic weight unit : 1mg.	1 mm	1 ml
96 G = 1 Tolā	1000 units : 1 g.	m, metre	l, litre
5 Tolā = 1 Chaṭāka			
16 Ch.=1 Seer, Se	1000 units : 1Kg.	Km.	Kl.
40 Se = 1 Maund, Mn			

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Chapter 9

Weights and Measures - 2 : Length and Time Units

Basis of Measure of Length in Jaina Canons : Space Point or Pradeśa

Jainas have an independant reality of space like time. It accommodates all the realities in the universe including itself and it forms the basis for their movements. It was included in five *Astikāyas* (reality with space points) from the very beginning and, hence, its position is somewhat different from the reality of time. The space has infiniteness, extension and omnipresence. It has no varieties of practical or ideal type like time. Nevertheless, it is assumed for practical purposes that the space occupied by an atom is known as *Pradeśa* or unit space point. The extension of space is denoted in the form of these space points. The infiniteness of space is due to its infinite number of space points. These are the basis for length or distance units. These also form the base for quantitative descriptions of the canons. These space points are also termed as *Ākāśa-aṇu* or space atoms like matter atoms. These represent the measure of minimum length and, thus, form its basic units. As the space has extension, it could be two or three-dimensional also. Hence this basic unit of *Pradeśa* also forms the basis for area and volume units.

It has been seen that time and distances are independant of each other, still the length units are described in canons as co-related with time units. The larger units of time *Palya* and *Sagara* -- have been defined on the basis of *Yojana* -- a length unit[1]. Though B., T. P., R. V. and J. D. P. follow this tradition, the A. D. S. and S. K. -1 deal with length units independantly.

Measures of Length in Bhagavatī and Other Jaina Canons

The Jaina canons like B., A. D. S., T. V., R. V., Ts., J. D. P. and others written between 100 B. C. and 12th century A. D. contain descriptions about length measures. Muniśrī[2] and Lishk et. al.[3] have discussed them as detailed in A. D. S. Accordingly, these have three varieties – (i) self measure, (ii) *utsedha* measure and (iii) *pramāṇa* measure. These are utilised in measuring lengths of different types and extensions shown in Table 1.

Table 1 : Uses of different Length Measures.

Name	Units	Equivalence	Uses
1. *Utsedha*	*Utsedha-aṅgula,* UA	0.5 A A	Measurement of heights of bodies and idols
2. Self or *Ātma*	*Ātmāṅgula,* A A	2 UA[4]	Measurement of utility and small useful things
3. *Pramāṇa*	*Pramāṇa-aṅgula,* PA	500/1000 UA	Measurements of islands, oceans, cities, solar system etc.

All the above canons have these three types of measures. A critical and comparative study of these measures is presented here which is summarised in Table 2 resulting in the following facts :

(i) All scholars have accepted the seven measure units from *Aṅgula,* A to *Yojana,* Y, as the practical units.

(ii) All agree upon *Aṅgula,* A as the practical unit of length. The category of this unit determines the value of Y. The basic A has been taken as UA.

(iii) The standard unit of *Ātmāṅgula,* AA is the fingertip of a standard healthy person with a height of 84 *Ātmāṅgulas*[5]. The human heights of 120, 108 or 96 AA depend upon different conditions and hence not taken as standard.

(iv) One *Ātmāṅgula,* AA, is canonically equal to 2 UA.

(v) The *Aṅgula* unit is generally 1-dimensional which

Table 2 : Units of Length in Some Jaina Canons (UA basis)

Bhagavatī, B	*Trilokaprajñapati*, TP	*Rājavārtika*, RV	*Jambuddīvapaṇṇatti*, JDP
[A] *Smaller Units*			
Basic Unit – *Paramāṇu* P	P	P	P
∞ P = 1 Utslakṣaṇas-lakshanika, U	∞∞∞ P = 1 Ubasannā-sanna, U	∞∞∞ P = 1 Utsaṅgyā-saṅgyā, U	∞∞∞ P- 1 Avasannā sanna, U
8 U = 1 Slakṣanaslakshanika, S	1 Sannāsanna, S	1 Saṅgyāsaṅgya,S	1 Sannāsanna, S
8 S = 1 Ūrdhvareṇu (Tṛtireṇu),Tr	1 Tṛtireṇu, Tr	1 Tr	1 Tr (Practical Atom)
8 Tr = 1 Trasaneṇu, Ts	1 Ts	1 Ts	1 Ts
8 Ts = 1 Rathareṇu, Rr	1 Rr	1 Ṙr	1 Rr
8 Rr = 1 Hairhead, UBHH (Devakuru-Uttarakuru)	1 Hairhead, UBHH (Uttama Bhogabhūmi)	1 Hairhead, UBHH (As in B)	1 UBHH (As in TP)
8 UBHH = 1 Hairhead, MBHH (Hari-Ramyaka area)	1 Hairhead, MBHH (Madhyama Bhogabhūmi)	1 MBHH (As in B)	1 MBHH (As in TP)
8 MBHH = 1 Hairhead, JBHH (Hemavala-Airāvata area)	1 JBHH (Jaghanya Bhogabhūmi)	1 JBHH (As in B)	1 JBHH (As in TP)
8 JBHH = Hairhead, PVHH (Pūrva Videha)	1 PVHH (Karmabhūmi)	1 PVHH (Bharata-Airāvata videha)	1 PVHH (As in TP)
8 PVHH = 1 Likṣā, Li	1 Li	1 Li	1 Li

Bhagavatī, B	*Trilokaprajñapati*, TP	*Rājavārtika*, RV	*Jambuddīvapaṇṇatti*, JDP
8 Li = 1 Yukā, Eu	1 Eu	1 Eu	1Eu
8 Eu = 1 Yavamadhya, Ya	1 Yava, Ya	1 Yavamadhya,Ya	1 Yava, Ya
8 Ya = 1 Aṅgula, A	1 A	1 A	1A
1000A = 1Pramāṇāṅgula,PA	500 A = 1 PA	500 A = 1 PA	500 A = 1 PA
[B] *Normal Units*			
6 A = 1 Pada, Pd	1 Pd	1 Pd	1 Pd
2 P = 12A = 1 Vitasti, V	1 V	1 V	1 V
2 V = 24A = 1 Hasta, H	1H	1 H	1 H
2 H = 48A = 1 Kukṣi, K	1 K	1 K	1 K
2 K = 96 A = 1 Dhanuṣa, D	1 D	1 D	1 D
2000 D = 1,92,000 A=1 Kośa, Ko	1 Ko	1 Ko	1 Ko
4 Ko = 7,68,000 A = 1 Yojanā, Y	1 Y	1 Y	1 Y
[C] *Larger Units*			
1000 A = 1 PA	500A = 1 PA	500 A = 1 PA	500 A = 1 PA
1000 Y = 1 PY	500Y = 1 PY	500Y = 1 PY	500Y = 1 PY
Jagaśreṇī J = 1 Rajju, R	As in B	As in B	As in B
1 Rajju, R = 1/7 Jagaśreṇī, 1/7J	As in B	As in B	As in B

is also known as *Sūcyāṅgula*[6]. It has, however, 2 or 3 dimensional units also.

(vi) One UY (*Utsedha Yojana*) has 7,68,000 Āṅgulas. Taking this as the last practical unit and assuming it as equal to 4Ko (*Kośa*) or 8 Miles (1 Mile = 1.66 Kms. = 1,66,000 cms.), 1 UA comes to be equal to 13, 28, 000/7, 68, 000 = 1.73 cms. Datta and Singh[7] have shown that one *Aṅguliparva* unit of the Buddhists is equivalent to 1.32" or 3.36 cms. The UA of Jaina has, thus, half the value of *Aṅguliparva,* i. e., it is equal to 1.68 cms. It is on this basis that 1 UY has been calculated to be equal to 8 miles or 13.28 kms. Thus, by interpolation of *Yojana,* Y or extrapolation of *aṅgula,* the UA has a value of 1.68-1.73 or 1.70 cm on the average.

In contrast, G. R. Jain[8] has assumed a *Hasta,* H = 24 UA = 45.70 cms. and hence 1 UA = 0.75" = 1.90 cms. This means a UY = 15.09 kms. or 100/11 miles instead of 13.28 kms as above. He has used this value to calculate the velocity of light based on its Vedic value of 4404 Y per *nimeṣa* (0.25 sec.) which is sufficiently close to the current value[9]. It must, however, be said that there is no confirmed base for this value of *Aṅgula,* though L. C. Jain[10] also agrees with this value. In contrast, Paṇini scales of length give the value of Y just about the half of it, i. e., 7.45 kms for UY which is quite close to the value suggested by a noted Jaina saint recently[11]. The acceptance of different values for the same basic unit creates doubt on the reliablity of calculations based on them.

Muni Candana[12] has also discussed the equivalence of UA on the basis of height of Lord Mahāvīra as 7 H. He maintains that the canonical height is based on UA which is equal to 3.5H in self measure. This is equal to 84 AA as 1 H = 24 AA and 1 UA = 0.5 AA. Hence, 7UA x 24/2 = 84 AA. If one assumes the UA as 1.70-1.90 cms., the Lord's height comes to be a minimum of 7 x 24 x 1.70 = 285.6 cms or 9.25 feet. This value seems to be inconsistent on all accounts for a man born in tropical Bihar area. Thus, he has questioned both

the above UA value. He also does not agree with the *Paramāṇu* or atom as the basic unit of length due to difficulties of its standardisation. Instead, he has supported the Jaina concept of *Aṅgula* standard on the basis of its being natural. He has given a value of 0.42" or 1.07 cms. to UA on the basis of many comparative references and logistics. Based on this, 1 UY = 5 miles or 8.30 kms and the height of the Lord as 5.84 feet or 178 cms which seems to be reasonable. He has given critical descriptions about the various body heights in literature and has canonically defined the standard UA. However, his concept of natural *Aṅgula* being standard could not be justified on account of its larger variablity than an atom.

Lishk et al[13] have given a fourth value for UY as 0.085 km (0.051 mile) equivalent to a value of approximately 0.001 cm for the UA. They have suggested that the values of these units should be decided on the basis of historical period and place. Thus, they seem to be adding to our difficulty in the process of standardisation and he has conveyed that the value of standard basic *Aṅgula* is variable, that is, it is a secondary standard rather than primary as desired by canons. One would like to wonder how a variable quantity could be treated as standard. Moreover, the authors of A. D. S., B., T. P., J. D. P. and S. K. belong to the same side of the country and there *should not be any variation in their equivalences and* descriptions. On the other hand, Akalaṅka and others originate from south and there should not be variations in their measures. But we see variations in not only both the groups, but in the same group also. One has to look as to when and how this variation started and should try to regularise it.

Length Units Smaller than Aṅgula

The length units based on UA are known as *Utsedha* measures representing their division-based category. The smallest unit of this category is atom. As this is very fine, there is another practical unit known as practical atom. When we interpolate the UA units towards smaller units, we reach the

point of practical atom. Though the J. D. P. mentions *'tṛtireṇu'* (*ūrdhvareṇu* of A. D. S.) as practical atom, the A. D. S. points it to be much smaller unit ($8^{-(12+\infty)}$). The real practical unit is an infinite multiple of this unit which has the same name in A. D. S. and B, but Table 2 shows that its name is different in T. P., R. V. and J. D. P. The same is the position of the second unit eight times larger. These two units should have the same names in current times. The cause of different names should also be looked into.

It is seen that there are 13 stages of smaller units upto U. A. in A. D. S. while there are 12 stages in other treatises including *Bhagavatī.* These treatises have combined the third and fifth units into one. The how and when of this change requires further consideration. Is it the mistake of the copyist? Currently, A. D. S. UA is larger by 10^1 unit, say.

Besides the above two differences, B (100 B. C.) and R. V. (~ 750 A. D.) have same names of other ten units upto *Aṅgula.* In contrast, there is similarity in names in T. P. and J. D. P. (names of hair heads and *yava* or *yavamadhya*). This difference should also be looked into and formalised for the current age.

It is clear from Table 2 that each of the 12 stages from *Aṅgula* backwards is eighth part of the preceding unit. The first unit, thus, have a value of 1.6×10^{10} A. If we multiply this value by its cm. equivalent of 1.70, the first unit seems to have a value of 2.72×10^{-10} cms. If one takes J. D. P. as little more practical, and the practical atom or *tṛtireṇu* is taken as 64 times the first unit, the practical atom has a dimension of 1.75×10^{-8} cm. which is the normal size of current atom. This suggests that J. D. P. concept of practical atom unit has the same atomic dimension as the current one. In contrast, the unit of length smaller than atomic one is that of atomic nucleus of 10^{-13} cm. This does not coincide with the canonical smallest unit of 10^{-10} cm. It is, therefore, reasonable to suggest that *tṛtireṇu*

or practical atom unit should be recognised as standard unit with a value of 10^{-8} cm. and the canonical descriptions be made consistent on this basis.

The units smaller than this may be simile based. The unit of infinite times infiniteth part ($1/\infty\infty$) seems to be imaginary as it does not seem to have a measurable value. This inference does not seem to be consistent with definitions of *Trasareṇu* and *Rathareṇu* of A. D. S.[14], but it seems better for accuracy. The A. D. S. definitions of these terms seem to be akin to Vaiśeṣikas who have *Trasareṇu* as their standard length unit equal in size to the colloidal dirt particles seen floating in light path. This unit is almost about 10^5 times larger than the Jaina smallest unit[15]. The discrepancy between the values of A. D. S. unit and other reference units has to be explained. The common names of some of the units in Jaina and Vaiśeṣika systems further suggest about looking into original source of these units.

Besides concurring with the size of the atom, the 1.70 cm. value of UA has another result to its credit. If one takes Y = 8 miles, the velocity of light based on Vedic data comes to be 1,40,930 miles/second (2.34×10^{10} cms./second).The value of 1.90 cm. for UA gives this value as 1,87,300 miles (3.10×10^{10} cm./second). These values are reasonably approaching current values. This is quite encouraging. But when we move for distances in solar systems, we find that we have the distances fourteen times larger for moon and thirty times lesser for Sun. This descrepancy is awaiting explanation. The other values of UA will increase the discrepancy still further.

It has already been pointed out that normal Aṅgula is 1-d and it is also named as *Sūcyāṅgula*. There seems to be some difference in R. V.[16] and J. D. P. discription of this unit. However, J. D. P. seems to be more reasonable. This Aṅgula has three varieties as shown in table 1. It is seen that there is a difference between the values of PA in Digambara and Śvetāmbara versions. No comment has been made on this

point by modern scholars who have mostly mentioned this difference. For equivalence, the two PA's must be equal. One could suggest that this difference could be accrued due to the two forms of Aṅgula units – self and *utsedha* – the one being (AA) double of the other (UA). It could be surmised that the Digambara PA is based on UA scale while the other PA is based on AA scale. Candana Muni has also indicated that while canons base their quantitative statements on UA basis, the commentators based their explanations on AA basis. If both are taken on the same scale, the difference may vanish. From the example of Lord's body's height, it is the UA scale coined by the canonists. Thus, the Śvetāmbara value converted to UA scale will give us the Digambara value of PA. Some calculations on this basis are given in table 3. If one takes the Śvetāmbara value of PA, the results will be highly discrepant.

The treatment of current equivalence of UA by many scholars to suit a particular value of a parameter, presents a situation which was prevalent in the scientific world some 150 years ago when lack of standardisation produced confusion and choked growth of science at proper rate. The same is the case with atom when scholars of the orient are pitching on the indivisiblity which has been shattered. Jaina[17] has pointed out some problems in this regard and suggested the description to be taken in historical perspective. However, there seems a tendency of some scholars to trace canonical origin for all the newly developed facts and to either overlook or keep mum over the scientific evaluation of a large number of canonical descriptions about the physical phenomena. Sometimes varied explanations are given for the same fact to make it scientifically consistent despite the fact that inconsistent or opposing results accrue from this trend. Some of the results of calculations based on current opinions regarding equivalent values of UA are shown in Table 3 which will substantiate the above statement. The calculations based on values of Lishk et. al. are most discordant. Table 3 will confuse one to decide the

Table 3 : Some Calculations based on Various Values of UA.

1. Values of UA, cms	1.70	1.90	1.07	0.001
2. UY (a) Km.	13.28	15.09	8.30	0.085
(b) miles	8.00	100/11	5.00	0.051
3. PY (500 UA), Km.	6640	7545	41.50	4.25
miles	4000	4545	2500	25.55
4. PY (1000 UA), Km.	13,280	15,090	8300	85.00
5. Size of Atom, cms.	1.7×10^{-8}	1.94×10^{-8}	1.09×10^{-8}	1.00×10^{-10}
6. Lord's body height, cm	285.6	319.2	178	0.168
7. Velocity of Light, UY				
(a) cms/sec	2.34×10^{10}	3.10×10^{10}	1.46×10^{10}	1.49×10^{8}
(b) miles/sec.	1,40,930	1,87,300	88080	898.5
8. Distance of Moon, PY				
(880 PY), lac miles	35.20	39.95	22.00	00.398
9. Distance of Sun, PY				
(800 PY), lac miles	32.00	36.36	20.00	0.204

truth or accuracy of the fact. It is worth consideration which of these values may be taken as applicable in all cases. Lord Mahāvīra must have given one value for each unit. How and when this variety of values of *Aṅgula* started is a problem for further research. One of the reasons for this might be the personal or literary communication gap between scholars of different or same periods. This gap has vanished in this century and it is the best time for uniformity in units and their values.

Area and Volume Units

When areas or volumes are to be expressed, the 2-d or 3-d units are used. The 2-d and 3-d *Aṅgula* units are known as *Prataraṅgula* (Pra) and *Ghanāṅgula* (GA) respectively. Their values are equal to the square and cube of the *Aṅgula* unit. They are shown in table 4.

Larger Units of Length

The UA-based *Yojana* Y, is the unit of length of practical and average value. It seems quite small for larger distances. Jaina ācāryas have, therefore, coined some larger length units like time. These are known as *Pramāṇa* units. The PA-based *yojana,* PY is a l-d unit in this direction. It has a value of 500 or 1000 times larger than UY or it is equivalent to 4000 or 8000 miles (1 UY = 8 miles). Other different values based on various values of UY are given in Table 3 varying between 6640-15090 km. These are measurable units.

With reference to the dimensions of the universe, there is one more unit named as *Rajju,* R. Canonically, it seems difficult to evaluate the current value for it as its calculations involve innumerable number. Despite this, Jaina[19] and Jaina[20] have calculated the value of R unit to be between 10^{16} -10^{21} kms. *Jagaśreṇī* is still a larger unit which is equal to 7 R. These larger units are just akin to the current units of light year which has a value of app. 10^{12} kms. This suggests that the larger units of the Jainas are sufficiently larger. These are also included in Table 4.

Table 4 : Current Values of Length Units in Jaina canons.

Unit	Current Values
1-d Units	
1. *Uvasannāsanna* or the first smallest unit	10^{-10} cm
2. *Trutireṇu* or Practical atom	10^{-8} cm.
3. SA or UA, cm.	0.001, 1.07, 1.70, 1.90
4. AA	2 UA
5. PA	500 A, 1000 A
6. *Yojana,* Y	
(a) UY, km.	0.085, 8.30, 13.28, 15.09
(b) PY, km (500 UY)	42.83, 4150, 6640, 7545
(1000 UY)	84.66, 8300, 13280, 15090
7. *Rajju,* R, km.	Innumerable *Yojanas,* $3.7 \times 10^{18} - 2.4 \times 10^{21}$
8. *Jagaśreṇi,* J, Km[18].	7 R; $2.6 \times 10^{19} - 1.68 \times 10^{23}$
2-d Units	
1. *Pratarāṅgula,* PrA	$(UA)^2$
2. *Jagapratara/Pratarāloka,* JP/PL	J^2
3-d Units	
1. *Ghanāṅgula,* GA	$(UA)^3$ = UA x PrA
2. *Ghanāloka,* GL	$J^3 = (7R)^3$ = 343 G R
3. *Khanduka,* k	1/64 GR (*Ghanarajju*)

The above larger units have also their corresponding 2-d and 3-d units named as *Pratarāloka* and *Ghanāloka* or *Loka* respectively. These are equal to square and cube of *Jagaśreṇi* unit. *Lokaprakāśa*[21] mentions another 3-d unit of *Khanduka,* k equal to 1/4 cube of a *Rajju.* This and its derivative units are not found in Digambara tradition.

The above description of larger units show the PY to be different in different traditions. Thus, descriptions based on them will have a variance and their reliablity will be more mythological. The current century, however, requires uniform value

of PY for proper evaluation of different descriptions in canons.

Some descriptions based on Larger Length Units

Many descriptions relating to larger distances, areas and volumes are available in Jaina canons. Some of them are presented here in current terms in Table 5.

Table 5 : Current Values for Some Canonical Description.

Items	Value Based on UY, Km.	PY based values, Km.
1. *Jambūdvīpa*		
(a) Diameter, 10^5Y	15×10^5	7.5×10^8
(b) Circumference, 3.16×10^5 Y	47.4×10^5	2.4×10^9
(c) Area	11.6×10^{11}	5.9×10^{14}
2. *Bharatakhaṇḍa*		
(a) Diameter, 526 Y	7890	3.5×10^6
3. *Mount Meru*		
(a) Under the earth, 1000 Y	–	7.5×10^6
(b) Over the earth, 99000Y	–	7.4×10^8
4. *Jambū Tree*		
(a) Diameter, 6Y	90	45,000
(b) Height, 6Y	90	45,000
(c) Length, 8Y	120	60,000
5. Height of Lord Ṛṣabha Deva 0.006 Y	910 meters	–
6. Height of Palace, 225D[25]	410 meters	–
7. Length of Palace, 300D	547 meters	–
8. Width of the Palace, 150 D	273 meters	–
9. Height of *Vijayadvāra*, 8Y[26]	120 Kms.	–
10. Diameter of *Vijayadvāra*, 4Y	60 Kms.	–

Let us first look at the island – *Jambūdvīpa* – in which we live. It is named after a *Jambū* tree in its center. It is 6Y in

height, 8Y in length and 6Y in diameter. The corresponding description is given in Table 5. It is clear that this can not be based on PY. Basing it on UY also, looks like an exaggeration. Not only this, 108 *Jambū* trees of half the dimension of the main tree are surrounding it. If we assume that there is at least one tree surrounding it in one direction, there will be a row of approximately 27 trees of 60 km length covering a distance of 27 x 60 = 1620 km. in one direction. This is equal to a distance from Delhi to Kazipeth, Bombay, Veraval and Howrah. It seems that more than half of the present India will contain only the family of *Jambū* trees. This description seems to be imaginary when one thinks the current distances and description of the trees.

The *Jambū* island has a diameter of 10^5 PY[23]. This island has the *Bharata Khaṇḍa* with an area of 1/190 of main island and a diameter of app. 526 PY. The island has mount *Meru*[24] in the center with is 99, 000 PY overland and 1000 PY underland. The current values for these details given in Table 5, suggest that it is very difficult to determine the category of reliability about them. Table 5 gives the values on the basis of UY = 15 kms. and PY as 500 UY. Calculations based on other values of UY also yield similar discrepant values. These values can only be presently explained on the basis of faith in canons and religion which do not seem to require verfication.

Time and Its Units : Smaller Units

Time is also one of the Jainistic realities assisting in the continuity and changes in the substances. There is some discussion whether it was originally included in the realities or added later. But it has come to stay. It consists of two varieties — ideal and apparent or *de jure* and *de facto*. The apparent time is countable and is useful for us. The ideal time is eternal and causes continuity. The substantiality of time has been discussed by many philosophers of east and west. Scientists call it as a frame of reference to measure present, past and future course of events as every change is related with time and space.

The time consists of units which never mix with each other and are always separate. They are like grains, invisible and inactive, represented by uni-dimensional mathematical series. This *de facto* time is expressed in three types of measures — (i) Numberable, (ii) Innumerable and (iii) Infinite time[27]. Out of these, the first one has values useful to us while the other two types have mathematical values of enormously complex nature and, therefore, comparatively not very much useful to us. They will not be discussed here except a brief reference. The different units and values of numerable time described in literature are summarised in Table 6.

Table 6 : Apparent Time Units in Jaina Canons.

A. D. S.	T. P.	R. V.	J. D. P.
1. *Samaya,* S = Basic unit in all references			
2. J. Y. S. or As S = *Āvalika,* A	As. S = 1 A	As. S = 1 A	As. S = 1 A
3. Ss. A = *Ucchvāsa/Prāṇa,* $4446\frac{2458}{3773}A^{29}$ = 1 P	- do -	- do -	= 1 P
4. 7 P = 1 *Stoka,* St	- do -	- do -	= 1 St
5. 7 St = 1 *Lāvā,* L	- do -	- do -	= 1 L
6. 38.5 L = 1 *Ghāti,* G	= Nali, N	-	-
7. 77 L = 1 *Muhūrta,* M	= 1 M	= 1 M	= 1 M
8. 30 M = 1 Day, D	= 1 D	= 1 D	= 1 D
9. 15 D = 1 Fortnight, F	= 1 F	= 1 F	= 1 F
10. 2 F = 1 Month, Mn	= 1 Mn	= 1 Mn	= 1 Mn
11. 2 Mn = 1 Season, Sn	= 1 Sn	= 1 Sn	= 1 Sn
12. 3 Sn = 1 *Ayana,* An	= 1 An	= 1 An	= 1 An
13. 2An = 12Mn = 1 Year, Yr	= 1 Yr	= 1 Yr	= 1 Yr
14. 5 Yr = 1 *Yuga,* Yg	= Yg	= 1 Yg	= 1 Yg

It must be pointed out here that the countable numbers are also classified in three types :

(i) Least countable number which is 2.

(ii) Middle countable number – it may be taken from 3 to (HN-1).

(iii) Highest countable number (HN). It may have value upto $10^{19/39}$ or more, a very large number[28].

Table 6 shows that there is difference in the name of some units in literature. R. V. does not mention the unit of *Nali* or *Ghāti* at all. There is difference in the values of *Prāṇa,* P units also. It is seen that despite *'Samaya'* being smallest unit of time, it is very difficult to define it mathematically. However, if *Nali* unit of T. P. and J. D. P. is taken as equivalent to *Ghāti,* G of A. D. S. and *Ucchvāsa* is the same as *Prāṇa,* we get coherent time units up to *'Prāṇa'* from below which is equal to 1/77 x 7 x 7 = 1/3773 M = 60 x 48/3773 = 0.75 (3/4) seconds approximately.

Above that, we have differing opinion regarding *Āvalī/ Āvalika,* A, as the value of *Saṅkhyāta,* Ss is not known. Though the *'Prāṇa'* is defined as the time for one complete respiration, yet it is said to be consisting of *saṅkhyāta Āvalikas* according to all references above except the one quoted by Muni Mahendraji[30]. This *Saṅkhyāta* is said to be equal to $84^{x} \times 10^{y}$ where x varies between 36-26 and y varies between 90-180 and this numerable number censists of 192-250 digits. It would mean that $10^{-192\ 250}$ *Āvalikas* make one *Prāṇa.* Interpolating, an *Āvalika* would be 10^{-190} to 10^{-248} second. The innumerable *'Samayas'* form an *Āvalika.* The value of innumerable number also varies according to its types (there are three types) but it must be greater than at least the value of numerable number, i. e., $10^{-192-250}$. Thus, with the minimum reckoning, the value of *'Samaya'* unit should be approximately 10^{-380} to 10^{-500} second. This value of *'Samaya'* may be least and finest mathematically, but it seems to be impractical at present. Besides the diversity in the value of innumerable, its value is not definite. Hence, to call it a basic unit requires serious consideration. Because of this, its absoluteness can not be taken as granted. Moreover, if *'Prāṇa'* is taken as the time taken for one complete respiration (one inhale and one exhale), which is roughly half a second, the *Āvalika* unit becomes still smaller. Hence, it

seems that *'Prāṇa'* as a unit of time should not be related to the time of respirations.

Muni Mahendra, however, refers the *Prāṇa* unit as consisting of 4446 or roughly 4450 *Āvalikas* which mean *Āvalika* unit is roughly 1.2×10^{-4} seconds of today. This seems to be more logical and practical value than the earlier. This value is measurable today, though a little bit difficultly. The *'Prāṇa'* (3/4 sec.) or *Āvalika* (10^{-4} sec.), thus, seem to be better practical units. On the basis of fineness, it is suggested that *Āvalika/Āvali,* A should be reckoned as a standard unit of time with a value of 10^{-4} second. A. K. Jain suggests still further. He points out the measurement of time upto 10^{-23} sec. This time should be taken as equal to a *'Samaya'*[31] unit and calculations may be made accordingly. This suggestion does not look logical as the value of *'Samaya'* is subject to further changes on finer experimentation or instrumental methods. The basic unit must have a fixed value. It would be like the varying equation of Jinistic atom with newer fundamental particles.

Larger Time Units

The time units described above are based on common unit of month or year and move towards smaller parts to the basic unit which has been found to be of immeasurable value-hence impractical and scientifically not accurate. The same situation is found when one moves towards larger time units. These units are required to define other bigger Jainological units of time used for pointing out of ages of hellish or heavenly beings and karmas. In these larger units, 84 or 84 lacs years (84×10^5) form the base. The cononical units based on these numbers are given in Table 7. It is presumed that the last of these units in any reference forms the value of highest numerable time (H. N. T.). Table 8 shows that there are diversities not only in the numerical value of the last units, but there is also a difference in their names and numbers of steps they are arrived at. It is also found that in A. D. S., J. K., R. V. and J. D. P., the multiple for each higher units is 84 lacs, but in T.

P., it is 84 in 13 units and 84 lacs in 17 units. It also seems that the *Parvaṅga* and *Parva* units have been left in T. P. by copyst's mistake as it is mentioned that numerical value of *Acalātma* is $84^{31} \times 10^{90}$ while it is less when these units are not counted. It is also found that the same names appear in different order in many reference leading to their different values. Thus, the value of H. N. T. varies between 10^{90} and 10^{180} a fact suggesting a situation where every scholar took his own order and value without caring for the others and common man. The standardisation of values of the canonical time units is, therefore, necessary not only to understand them accurately but also to evaluate their contents, contribution and credibility.

Table 7 : Larger Units of Time in Jaina Canons.

	A. D. S. 1	J. K. 2	T. P. 3	R. V. 4	J. D. P. 5
1.	*Pūrvāṅga*	*Pūrvāṅga*	*Pūrvāṅga*	*Pūrvāṅga*	*Pūrvāṅga*
2.	*Pūrva*	*Pūrva*	*Pūrva*	*Pūrva*	*Pūrva*
3.	*Trutitāṅga*	*Latāṅga*	*Niyutāṅga*	*Niyutāṅga*	*Parvāṅga*
4.	*Trutita*	*Latā*	*Niyuta*	*Niyuta*	*Parva*
5.	*Adadāṅga*	*Mahā-latāṅga*	*Kumud-āṅga*	*Kumud-āṅga*	*Kumud-āṅga*
6.	*Adada*	*Mahālatā*	*Kumuda*	*Kumuda*	*Kumuda*
7.	*Avavāṅga*	*Nalināṅga*	*Padmāṅga*	*Padmāṅga*	*Niyutāṅga*
8.	*Avava*	*Nalina*	*Padma*	*Padma*	*Niyuta*
9.	*Huhuk-āṅga*	*Mahānalin-āṅga*	*Nalināṅga*	*Nalināṅga*	*Padmāṅga*
10.	*Huhuka*	*Mahānalina*	*Nalina*	*Nalina*	*Padma*
11.	*Utpalāṅga*	*Padmāṅga*	*Kamal-āṅga*	*Kamal-āṅga*	*Nalināṅga*
12.	*Utpal*	*Padma*	*Kamala*	*Kamala*	*Nalina*
13.	*Padmāṅga*	*Mahāpad-māṅga*	*Trutitāṅga*	*Trutitāṅga*	*Amalāṅga*

1	2	3	4	5
14. *Padma*	*Mahā-padma*	*Trutita*	*Trutita*	*Kamala*
15. *Nalināṅga*	*Kama-lāṅga*	*Atātāṅga*	*Atātāṅga*	*Trutitāṅga*
16. *Nalina*	*Kamala*	*Atata*	*Atata*	*Trutita*
17. *Arthani-purāṅga*	*Mahāka-malāṅga*	*Amām-āṅga*	*Amām-āṅga*	*Atātāṅga*
18. *Arthani-pura*	*Mahā-kamala*	*Amama*	*Amama*	*Atata*
19. *Ayutāṅga*	*Kudu-māṅga*	*Hahāṅga*	*Parvāṅga*	*Amamāṅga*
20. *Ayuta*	*Kuduma*	*Hāhā*	*Parva*	*Amamā*
21. *Prayutā-ṅga*	*Mahāku-dumāṅga*	*Hūhāṅga*	*Hūhāṅga*	*Hāhāṅga*
22. *Prayuta*	*Mahā-kuduma*	*Huhu*	*Huhu*	*Hāhā*
23. *Nayutāṅga*	*Trutitāṅga*	*Latāṅga*	*Latāṅga*	*Hūhāṅga*
24. *Nayuta*	*Trutita*	*Latā*	*Latā*	*Hūhū*
25. *Chūlikāṅga*	*Mahātru-titāṅga*	*Mahāla-tāṅga*	*Mahala-tāṅga*	*Latāṅga*
26. *Chūlika*	*Mahātrutita*	*Mahālatā*	*Mahālatā*	*Latā*
27. *Śīrṣapra-helikāṅga*	*Adādāṅga*	*Śrīkalpa*	–	*Mahālat-āṅga*
28. *Śīrśapra-helikā*	*Adāda*	*Hastapra-helikā*	–	*Mahālatā*
29. –	*Mahādā-dāṅga*	*Acalātmā*	–	*Śīrṣa-prakampita*
30. –	*Mahādādā*	*Parvāṅga*	–	*Hastapra-helita*
31. –	*Hūhāṅga*	*Parva*	–	*Acalātmā*
32. –	*Hūhū*	–	–	–
33. –	*Mahāhū-hāṅga*	–	–	–

1	2	3	4	5
34. —	*Mahāhūhū*	—	—	—
35. —	*Śirṣapra-helikāṅga*	—	—	—
36. —	*Śirṣapra-helikā*	—	—	—
Numerable Time				
$84^{28}x10^{140}$	$84^{36}x10^{180}$	$84^{31}x10^{90}$	$84^{26}x10^{130}$	$84^{31}x10^{165}$
Basis				
$84x10^{5}$	$84x10^{5}$	$84\&84x10^{5}$	$84x10^{5}$	$84x10^{5}$

Table 8 : Details of H. N. T. in various references.

Reference	Last Name of Unit	Numerical Value	Number of Stages
1. A. D. S.	*Śirṣaprahelikā*	$84^{28}x10^{140}$	28
2. J. K.	"	$84^{36}x10^{180}$	36
3. T. P.	*Acalātmā*	$84^{31}x10^{90}$	31
4. R. V.	*Mahālatā*	$84^{26}x10^{130}$	26
5. J. D. P.	*Acalātmā*	$84^{31}x10^{165}$	31

Innumerable or Asaṅkhyāta Time Units (I. T. U.)

Besides the above small or large numerable time units, Jainology has also postulated innumerable time units larger than H. N. T. Actually, the name of these units suggests that they could not be counted but they have their values which in every case should be larger than H. N. T. These time units are expressed in simile measures and have two types —*Palyopama* and *Sāgaropama.* They are related to each other by a factor of 10^{14}. Each of these units is further divided into three classes as shown below in Table 9. It seems there is some difference in A. D. S., T. P. and R. V. regarding these classes.

The definition of *Palyopama* is too complex and mathematical to be given here but many scholars have calculated the values of its various classes in both the traditions[20]. The

A. D. S. tradition has some sub-classes for these units. These values also show large diversities not amenable to scientific credibility. However, while T. P. tradition has only *Vyavahāra Palyopama* as a numerable unit with a factor of only 10^{46}, the A. D. S. tradition has two such numerable units of gross/ *Uddhāra* and *Addhā Palya* with factor of 10^{36} and 10^{38} respectively. These diverse values make it difficult to assess the canonical facts based on them. How these numerical units have been included in this class could be a good subject for researchers. These observations are summarised in Table 10. However, A. D. S. points out that by adding one to the numerable number, it becomes innumerable.

Table 9 : Innumerable Time Units, I. T. U. (as per T. P., R. V.).

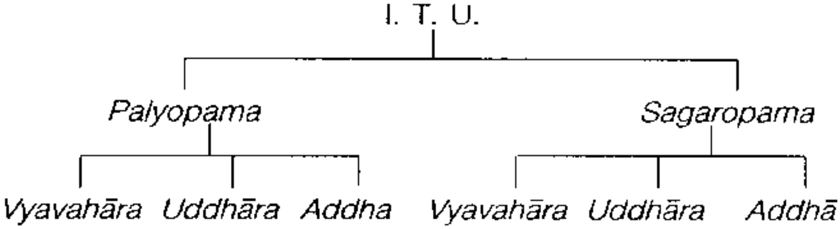

Table 10 : Values of *Palyopama* Units.

	A. D. S.	T. P.
1. *Vyavahāra palyopama,* gross	–	4.13×10^{46} yrs
2. *Vyavahāra palyopama,* fine	–	–
3. *Uddhāra palyopama,* gross	3.3×10^{36}xa *samayas*	4.13×10^{51} xa* years
4. *Uddhāra palyopama,* fine	3.3×10^{36}xa* *samayas*	–
5. *Addhā palyopama,* gross	3.3×10^{38} years	4.13×10^{51}x a** years
6. *Addhā palyopama,* fine	3.3×10^{38}xa* years	–

*, ** This indicates different types of innumerables.

By multiplying different *Palyopamas* by 10^{14}; different

types of *Sagaropamas* could be evaluated. A. D. S. has another type of *Palyopama* too-spatial *Palyopama* based on space points.

Miscellaneous Time Units

Besides the above units, there are some other units indicated in the canons. One of them is *Pūrvakoṭi* which is a numerable time of 7056 $\times 10^{10}$ yrs. Another is *Koḍākoḍī* which is a crore multiplied by a crore, i. e., 10^{14} yrs. Some other smaller units may also be available.

Uses of Innumerable Time Units

A good number of *Palyopama* units are not used but they form the calculation based for other useful units. One of the important uses of these units has been to point out the maximum ages of various living beings shown in Table 11 according to Umāsvātī tradition. It is surprising that human beings have been rated with hellish beings in respect of their maximum age and with animals with respect of their minimum age, whereas it is said that it is the human beings which have the capacity and power of attaining full salvation and that they are the best of living beings.

Table 11 : Ages of Different Living Beings.[34]

	Category	Minimum age	Maximum age
1.	Human Beings		
	(a) Normal world	48 mts.	3 *Palyopama* yrs.
	(b) *Videha* world	48 mts.	7056x10^{10} to H. N. T. yrs
2.	Animal Beings	48 mts.	3 *Palyopama* yrs.
3.	Hellish beings	10,000 to 22 *Sāgaropama* yrs.	1-33 *Sāgaropama* yrs
4.	Heavenly beings	10,000 to 32 *Sāgaropama* yrs.	1.5 *Palyopama* to 33 *Sāgaropama* yrs

Per chance, this has been done with a view to march ahead more for spiritual values resulting in heavenly life of partial

or full salvation. But the span of maximum life for them seems to be too much with 10^{36-46} yrs. specially in the scientific age when the present world is supposed to be existing for about 10^{10} yrs. only. This point needs deeper thoughts.

Cause of Differences in Time Units

There does not seem to be much difference in time units on smaller scales as they have been common since *Bhagavatī* days in both the Jaina traditions. However, there is a good amount of difference in larger units. Muni Mahendra suggests that this difference might have arisen due to two *Āgamic* councils. The *Bhagavatī* and A. D. S. follow Valabhi council while *Jyotiśkaraṇḍaka* seems to follow *Mathurī* council[35]. There is no discussion on difference in Digambara tradition and it seems faith reigned over these discrepancies disregarding even the crediblity aspect of the future. However, this is a problem for the canonists to clarify.

Useful Time Units and Their Use

It must have been clear from the above that interpolation and extrapolation of common units of time in Jainology has a large number of problems to understand the world and its event in their true perspective. Many other Indian systems have also their time units. They can be described in two categories — (i) *Ghāṭi* based (24 mts.) and (ii) Muhūrta based (48 mts.)[36]. These are shown in Table 12 with their equivalents of today. The *Ghāṭi*-based units seem to be finer but Prof. Jaina seems to favour the other ones. On this basis, he has been able to calculate the velocity of light with a value of 1,87,670 miles per second as mentioned earlier. Similarly, by assuming *Nimeṣa* =1/4 sec., he has also been able to calculate the numerical value of *Rajju* R-another unit of distance for larger dimensions as equvalent to 10^{18-21} miles based on the data of Colebrook and Einstein[37]. This has been done despite the fact that one tradition of Jainas assumes its value to be known to the omniscients only.

Table 12 : Useful Time Units in Other Systems

(a) *Ghāti*-based	(b) *Muhūrta*-based
1. 60 *Prativipalāmśa* = 1 *Prativipaḷa*, PV	15 *Nimeśa* = 1 *Kaṣṭā*, K
2. 60 PV = 1 *Vipala*, V	30 K = 1 *Kalā*, Kl
3. 60 V = 1 *Pala*, P	30 Kl = 1 *Muhūrta*, M (48 mts.)
4. 60 P= 1 Ghaṭī, G (24 mts)	
1 minute = 54 x 10^4 *Prati-vipalāmśa* (P.Vs.)	= 281 N (*Nimeṣa*)
1 Second = 9 x 10^3 P. Vs.	= 4.7 N
1 P. V. = 10^{-4} sec. (app.) ; 1N = 1/4 sec (app.).	

Thus, P. V. seems to be equivalent to the unit of *Āvalika* (10^{-4} sec.) of Jainas as stated above. This calculated equivalence is surprising and worth following.

This author has no idea whether any useful values have been calculated by Jaina seers on the basis of *Palyopama* or *Samaya* units. It seems that even on doing so, no comparable or pertinent data could be obtained as above.

The overall study of Jainological weights and measures seems to substantiate the fact that the Jainas had developed a tendency to create excellence in details upto the extent of miraculous mythology in comparison to other systems. The same trend is seen in the case of time and length measures on the minimum and maximum side of the scales. Whereas the other systems describe them in reasonable units, the Jainas go in for mythological units as seen in many cases in Table 13. This process neither serves the truth nor it has a scientific aspect. It is, therefore, necessary to adopt a better method of quantitative descriptions which have a realistic base and consistency in results.

In the absence of this suggested trend, a continuous erosion of faith in religion itself has been taking place.

Table 13 : Comparative Descriptions of Hindus and the Jainas.

Description	Hindus	Jainas
1. Age of Universe Cycle	10^{15} yrs.	10^{77} yrs.
2. Deitification of Idols	Simple *pūjā*	Five-auspicated Festival (*Gaja-ratha*)
3. Cosmography	4-7 continents	Innumerable continents
4. Incarnations/*Tīrthaṅkaras*	10/24	3x24 (present, past, future)
5. Queens of a *Cakravartī*	16,000	96,000
6. Body-height (Ṛṣabhadeva)	–	800 metres
7. Age of Neminātha/Kṛṣṇa	100 yrs.	1000 yrs.
8. Unit of Time	1/4-10^{-4} sec.	10^{-380}-10^{-500}sec.
9. Unit of Length	10^{-4} cm.	10^{-8} or 10^{-10}cm.
10. *Prastha,* Pr	16 *palas*	64 *palas* (ADS)
11. Human characters	11	18,000/84 lacs[39]
12. Monarch's possessions[40]	–	10^{14} ploughs Chariots : 84 lacs Horses : 18 crores Soldiers : 48 crores Cities : 75,000

Dr. Upadhye[38] has exclaimed similarly in his editorial in T. P. adding that canonical descriptions are not appealing to the scientific world in general. The twentieth century Jainists have a duty to improve the situation. If we wish to convert the mythological category into reliablity, one has to fix the canonical length and time units and other measures with a definite current value uniformly. Most probably, this may not be possible. In that case, we must not insist on their permanent truth on omniscient wordings. They must be taken in historical perspec-tive as an attractive mythology so common in all the systems of olden periods. A Khārvela, Pāṭaliputra or Valabhī type council may also be a way out.

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Chapter 10

Contents of Physics - 1 : Heat and Light

Origin of Heat and Light

The first canonical book, *Ācārāṅga*[1], mentions about non-harming of fire-bodied (*Taijasa*) beings. This confirms that the Jainas have followed the general Indian concept of sun and fire as god (i.e. living entities) since the early times. Their quality of hotness is, thus, found in all living beings. Their hotness is not only the life of their own, but it gives life to all other living and non-living world. The term *Taijasa* means as produced from hotness or causing hotness[2]. *Bhagavatī*[3] mentions that even the so-called inanimate matter has capacities of shining, brightening, lightening and glowing. All these are facets of *Taijasa*. One experiences daily that when one falls sick, his body gets hot. When one dies, one gets cool gradually in the end. This hotness and breathing are signs of living body. The first and later intense hotness and the last ashy coldness of wooden coal fire are just akin to the cycle of birth and death of the living.

In olden days, fire was the only best known common form of energy. Hence every substance containing hotness was given a general name of fire-bodied substances (*Agnikāyika* or *Taijaskāyika*). Their order of livingness is, though, of a lower quality than that of human beings as they are said to contain one sense, sense of touch while man and other sub-humans may contain upto five senses.

The scholars have pointed out that the heat present in the substances and changes in them is not a fundamental property of theirs. The Vaiśeṣika school has described water as cold in touch, but in cold days and at sunrise, look at the water in river or tank, you see vapours arising out of it. Where

does this heat in water come from ? The source giving this hotness or life in matter is an energy which might be called soul or *Ātman.* It may be called spiritual or supernatural force. In olden days, such and other unintelligible phenomena were said to be due to this force. This makes it clear that the basic sources of life is an energy which exists in every living one in the form of heat. Is it that the so called *Ātman* a form of energy of heat ? According to Jainas, hot bodies are living ones. On this basis, sun, fire, burning lamp, sewage, frictional fire and the like are all living substances inherently. They come under the category of fire-bodied one-sensed living substances[4]. These substances are also called light-bodied (*Taijaskāyika*) as their bodies have normally (specially fire) a glistening light. They contain hotness with shining. In Jaina canons, light is not only associated with body or mass alone as *taijasa* body but with energy also in the form of *Tejoleśyā* (aura). These bodies have been said to possess breathing and ageing. Their age varies between 48 minutes to three days[5]. A burning coal piece also lights with hotness. This is also a form of energy. The source of this light is also as supernatural as that of heat[6]. Canonically, heat and light, are the two forces which are contained in the living matter. In fact, there are some more natural forces which contribute to livingness. Thus, the word *'agni'* or *'taijasa'* should be taken to mean a form of energy containing heat and light.

Bhagavatī[7] mentions about cycle of changes in heat and *taijasa* forms. Later scholars have elaborated many facets of these forms as below :

(1) It may be in the form of physique-making *kārmic* matter which causes glistening hotness to the body (*taijasa,* luminous or caloric body). Some, now, call it as electrical or electromagnetic body[8]. It may be ejectable or non-ejectable, auspicious or inauspicious. It could be associated with living or non-living[9].

(ii) It may have the form of *Taijasa* emanations or

aural colourations from the body (*tejolesyā*).

(iii) It may be in the form of extrications of spatial units of soul (*Samudghāta*)

(iv) It may be in the form of homologous atomic variforms called *Vargaṇās*. All these facets are related with some phenomenon associated with *taijasa* or fire.

Naiyāyikas[10] have also *Taijasa* with hot touch only with no light effect. They have four forms depending upon sources:

(i) Earthy or material fire like that from wood.

(ii) Mineral like gold and some other metals (now radium etc.)

(iii) Digestive fire working in stomach for metabolism.

(iv) Divine fire like electric lightening, sun, moon, planets etc.

However, they presume it to be non-living only. All the Jaina forms of *taijasa* are in the fine atomic or their aggregatal forms.

The canons state that the different forms of *taijasa* aggregates (*Skandhas*) are found in three varieties : (i) Heat, (ii) light and (iii) electric lightening. This means the term *Taijasa* is more general and represents the natural energies of heat, light and electricity known in canonical days and produced or obtained from natural sources[11]. Besides, there are sacrificial fires (three types) for religious purposes in which sacredness arises due to deity-worship factor. These are taken to be psychologically different from general fires. There are also volitional fires like fire of anger, meditation and sex which indicate their effect like fire[12].

The later Jaina[13] canons have given following arguments to prove livingness of *Taijasa* bodies in contrast to the Nyāya school :

(i) The light/hotness is due to vital force (soul) because it resides in the body just like light in firefly, hotness in a sick person or planets.

(ii) The fire or *taijasa* is living because it grows and

decays due to denaturation or fuelling.

(iii)The human body is living because of the presence of the digestive fire in the bodies.

(iv)There are many fire-gods mentioned in literature like *asura,* keepers, sky gods, planetary gods, etc. They are all living and some of them creating troubles for the ascetics in olden days which were overcome due to Lord Rāma.

Contrary to the vital force theory of energies as above, *Sthānāṅga*[14] shows some improvement. It points out that both-the light forms (shadow, moonlight, darkness) and heat itself could be living as well as non-living. That is why, hot and cold touches have been included in the basic properties of non-living matter. These touches represent the natural internal thermal nature of matter. It could be surmised that at some critical thermal point, the matter may be called living. The canons also point out the criteria for livingness. Initially every thing in the world is supposed to be living until it is struck, weapon-operated, torn or denatured[15] disturbing natural thermal equilibrium of the system.

[A] Heat

The term *Ātapa* for heat is traceable in *Sthānāṅga* and *Uttarādhyayana*[16]. Kundakunda and *Mūlācāra* have the term *'Agni'* with reference to the one-sensed living. These compositions do not give other details of these beings and mattergy (*pudgala*) involving related phenomena. However, other terms like *Taijasa, Pratāpa, Tāpa* are also observed in canons besides *'agni'* and *'ātapa'.* Etymologically, these terms may have specific meanings, but they could be taken as synonyms[17] for heat (Heat and light) for our purposes.

It seems there was a concept of simultaneity of heat and light[18] but the scholars like Akalaṅka[19] knew the distinction between the two by their different functions. He pointed out that heat causes the substances to burn, to cook or digest foods or bake bricks. It leads to sweating of the body and gets

things illuminated like lamp[20]. It also leads to change of states like solidifying the milk by heating, liquefaction and solidification of earthy compounds and liquids, solidification of gaseous vapours, etc. It has also been pointed out that the air helps the heat of fire during burning. In contrast, light and glistening fire illuminates things, causes them to be visible and subject of knowledge.

Pujyapāda[21] defines *ātapa* as hot light exemplified by sunlight. This is supported by many later authors. This suggests light energy is developed out of heat at some point giving visibility to the sources and surroundings.

Nature of Heat

Upadhye[22] has raised a point about the current obscurity of organic nature of the first four one-sensed beings in canons including *'agni* or *taijasa'*. While on the one hand, he is pleased with Jainism's antiquity on the animistic basis suggested by European scholars, he, on the other hand, is not satisfied with the idea of livingness in non-living physical objects like water and fire. He laments that even the great scriptural commentators have not been helpful to clarify these canonical and commonsense contradictions. He feels that association of fine microscopic organisms with these non-living entities may fall un-intelligible in case of fire and *Ātapa*.

However, the gross forms of fire/heat available to us may be treated as non-living because of denaturation through its passage to us. Thus, we have two sources of fire/heat : (i) natural like sunlight, gemfire and volcanoes, etc. and (ii) non-natural like burning of fuels, lamps and frictional fire. Many more sources of non-natural fires have been added in twentieth century. The basic question is not that of the sources but that of the nature of heat.

Despite vital force theory of origin, Jaina canons point heat as material in nature[23]. It is one of the finer forms of transformation of matter. As matter is basically said to be atomic in nature, heat must be atomic. Jainas, thus, have heat

energy with corpuscular nature. Its atomic nature is confirmed from the fact that when a stone or iron mass is heated in fire, fire atoms enter into them making them hot, though the process of heat transfer has not been mentioned in canons before. The earth and fire are opponents of each other[24]. Its material nature is proved by three facts : (i) it gives heat (ii) it lets sweat and (iii) it is hot by itself.

Actually, it is not really atomic but atomic aggregate or *skandha,* of course, an invisible one. Its size varies between infinite atomic variforms and sound variforms according to homologous grouping or variform classification[25]. This will contain at least infinite times infinite homologous atoms. When converted into practical atomic dimensions, the heat corpuscles will be somewhat less than 10^{-13} cm. in size and about 10^{-40}g. in weight as per current Einstein's eqation though not actually applicable to microparticles like heat[26]. This means that heat particles should be invisible occupying finer microbodies. It is because of this ultra-fineness that these corpuscles enter other bodies in direct or indirect contact elastically or collidingly. In contrast with this, the earlier canon, *Bhagavatī*[27] mentions that heat particles are finer than earth and water particles while they are grosser than plant and air particles. This seems to be highly gross statement and the later canons seem to have improved upon it.

The atomic material nature of heat envisages that heat particles must have qualities of colour (white or black), touch (hot), taste and smell; though the later two qualities may be commonly non-manifest or indistinct[28]. The atomic variforms of heat corpuscles may be fine or gross[29]. The fine corpuscles are found everywhere while the gross heat particles are found in part of the world. It is these later which are classified into innumerable varieties. Both types of these heat particles are sense-imperceptible. The intensity and nature of their hotness varies with respect to many of their qualities. These corpuscles may be hot at the base and/or throughout their mass[30].

Classification

Prajñāpanā[31] classifies the fire-bodied substances into two classes – visible and non-visible. It also has a wider classification detailed earlier. *Pūjyapāda*[32] classified the fire-bodied substances in one more way. Accordingly, they have four types -- (i) fire, (ii) fire-body, (iii) fire-bodied and (iv) fire-soul. Out of them, only the third variety (and fourth variety also) is said to be living, the rest being hot and non-living. This classification is more basic. All types of fire bodies may be developed or non-developed. The *Prajñāpanā* classification details indicate that in olden days, light, gem light and electricity – all were supposed to be firy substances. In general, heat may be said to be of three types :

(i) Wood fire (*Kāṣṭhāgni*)
(ii) Frictional fire (*Gharṣaṇāgni*)
(iii) Interconvertible fire

These can be in four different forms as shown in Table 1 below :

Table 1 : Various Forms of Hot Bodies.

(i) Heat forms	(ii) Heat/light	(iii) Electricity	(iv) Light
Ashy fire (straw etc.)	Flame	Electric lightening	Sunlight
Fuelless fire	Lampfire	Starfires	Moon-light
Gem fire (mineral)	Frictional fire	*Ulkā*	–
	Transformational fire	Electric sparks	–
	Burning coal (smokeless)		

It is clear that none of the classifications include sun and stars though the canons indicate their hotness and heating capacity of their rays. In fact, the sun and stars have been included among the four types of five-sensed celestial beings which are highly developed ones.

There is a basic query about what burns in the lamp to produce hot light. It is said that it is neither lamp, wick nor oil in it which burns but it is the fire which burns. Though we cannot justify this point because of the oxidation theory of combustion of fuels, still the Jaina seers could try to peep into common phenomena like this gives credit to them for their zeal for knowledge during pre-christian days[33].

The above canonical description about it leads us to the following postulates therein :

(i) Heat is a form of energy.

(ii) It is corpuscular in nature. Its corpuscles are made up of innumerable atoms.

(iii) Heat heats the substances, cooks them, destroys them, absorbed by them. It also leads to changes in states of substances.

(iv) When the substances are heated, atoms of heat enter elastically into them.

(v) Light and electricity are also forms of heat. The glow of gems is also due to heat. Heat is available in the forms of electricity and light.

(vi) Heat is a characteristic of life.

(vii) Fire bodied substances are of various types.

We will, now, examine these postulates with reference to current science of physics which has to say the following facts about heat pointwise[34] :

(i) Heat is a form of energy.

(ii) Its nature is dual. Some of its properties are explained by assuming it as wave and some are explained by assuming it as corpuscular. The wave-length of heat is greater than red light. The particles of heat are not atomic but they consist of finer particles called electrons. They have a specific minimum energy to be called as heat.

The wave nature of heat is not specificallly described in canons but the size of these particles may lead to such a guess. The corpuscular nature of heat was held by western

scholars from the early Christian era upto Newtonian age. It is only in late nineteenth and early twentieth century that heat has been assigned a dual nature with proper verification of its properties. Thus, the Jaina view is more similar to Newtonic age.

Now, not only the nature of heat is much more clear, but it can also be quantitatively measured. The gross idea about the quantity of heat can be obtained by thermometers and its accurate measurement is done by calorimetric methods. The canons have no mention about this aspect.

It may, however, be added that Jainas have given two types of atoms : one with mass and the other without mass. In this sense, heat energy might be equated as particles without mass which can convert into particles with mass under suitable conditions. Thus, heat may be considered as a 4-touch atomic[35].

(iii) The various functions are agreeable to the physicists. But how this happens – is not very clear from canons except the fact that heat enters elastically into the matter. It is now known that there are two different methods of heating : (i) heating the iron and (ii) heating the water. The solar heat reaches us by an altogether different method of radiation. The earlier methods are known as conduction and convection. The canons and their commentaries describe none of these methods. These heat transfer processes have been discovered by sharper observation and analytical technics, per chance unknown during canonical periods.

(iv) The change of states of matter by heat takes place due to increase in their motion of particles by thermal energy rather than only by the entry of heat atoms in them. Moreover, changes in states have not been characterised. That is why, there seems to be no mention of common concept like melting and boiling points of substances. However, a crude guess about boiling point of water may be made by the fact that its energy does not change much on boiling to convert it into fire. It may be lost by boiling due to vapourisation.

(v) Heat is a form of energy and it can change into other forms of energy like light and electricity. There are large number of examples now to illustrate this interchange. But we do not find any mention in canons that heat could be converted into mechanical work and it can run machines. The process is known only since James Watt whose steam engine has revolutionised our whole civilisation. Similarly, conversion of electricity into heat as in heaters does not find any mention.

(vi) The relation with heat and life is specific in Jaina philosophy. In fact, it is now known that all substances from atom to the Himalayas have certain energy contained in them during their formation which is available during their transformation and breakdown. It is due to this internal energy that substances are found in different states in nature. If there happens some change in this energy, the temperature changes. Lowering of energy lowers the temperature and vice-versa. As the basic particle of matter has an inherent energy, it contains heat whatever its quantity may be. This fact applies to both stones and animals. If energy is a criteria of life, does it not mean that as it is all pervasive in the universe, the whole matter in it should be living initially ? This cannot be, then, divided into living and non-living. The canons support this view as they say that some disturbance or treatment makes living as non-living[36]. Does this mean that this dual classification of entities is a later development?Possibly, it may be a reason that the earth etc. have been said to be living in canons. One looks rocks grow and reach a height. This shows their birth and growth. The six-fold description of living of the first book – *Ācārāṅga* and *Uttarādhyayana* holds basis for this view. That is why, boiled water has been assumed to be non-living and prescribed for Jaina monks. This principle of heat characterising life makes Jainas as Vedāntins. Are we ready for this interpretation ?

The current scientific theory states that heat is a general constituent of matter. This can not specifically be assigned to

the living only. When there is less than the critical for the livingness, the matter is non-living. The so-called electro-magnetic field theory about the living also points out about the material nature of the living with a critical amount of electric power associated with it which is a measurable quantity. The roundabout treatment of livingness does lead us to confuse matters. It is, thus, clear that canonical concepts about heat are only qualitative and represent a gross observational order of early days. At times, some explanations have been given for some facts, but these are not completely satisfying to a man of today. Nevertheless, it is important that Jaina scholars could take up these matters of worldly life and many of their statements still stand. Of course, many more additions have been made.

(vii) Looking at various classes of the fire-bodied substances, one finds a large amount of difference in their nature. They represent the sources of heat rather than varieties of heat itself. Of course, the observation of fuelless or smoke-less heat is surprising during those days. These are the newer developments of this ege. However, the difference of heat sources has not been clarified on structural basis. Their uni-formity has been shown due to their common atomic nature. All the canonical classes are visual and obtained from natural sources. Now, it is known that wood-fires are due to burning of carbon in air. This fire is chemical in nature. If there is no air, it cannot be produced. Frictional and other fires are non-chemical in nature produced by physical processes mainly. Air is not necessary for these fires. The enormous heat due to fission and fusion also comes under this class which finds no mention in canons. Air, sometimes, causes obstructions in production of non-chemical fires. Invisible radiation heats also do not find mention in canons. The examples like gem-fire or meteoritic fires are now said to be light or electric effects rather than heat effects, though invisible heat is involved in them.

From the above statements about the physicists' con-

cepts regarding heat, one can easily guess about the advance in knowledge about heat in current period. It suggests that large amount of qualitative and quantitative aspects have been added and theories about nature, origin and functions of heat have also been modified.

[B] Light

Many light effects were observed during canonical periods. It makes objects visible and we can see and know about them. We see the seven-coloured rainbow. The shadow and images of the objects, mirage, colours, darkness, reflection and refraction phenomena, micro- and macro-scoping and the like are other effects of light. Some of them are described in Prākṛta canons along with concepts about the nature of light summarised below.

Nature of Light

Prākṛta canons contain stray accounts of the nature and phemomena concerned with light. The current word light is denoted by many terms in canons – (i) *Agni*, (ii) *Taijasa* (iii) *Ātapa*, (iv) *Tāpa*, (v) *Udyota* (cold light) (vi) Āloka (sunlight), (vii) *Prabhā* (lustre), (viii) *Prakāśa* (light) and (ix) *Jyotsnā* (moon-light). The first four and the sixth terms are associated with light accompanied with major portions of heat while the rest denote light with minor content of heat. They may represent cold light. Though *Uttarādhyayana*[37] uses the term *prabhā* – a nearly synonym for light (*prakāśa*) as a modification of mattergy, there is no similar term in *Tattvārtha-sūtra* like that used for sound. Of course, the canons mention the effects of light like darkness and shadow besides the terms like cold light (*udyota*) and hot light (*Ātapa*). It is said that all lit materials have different power or energy of light. *Dhavalā* and *Samaya-sāra* assume it as power or energy to know about things[38]. Akalaṅka points out functions of light – (i) illumination, (ii) colour and shape of the objects and (iii) seeing and knowing about the objects through eyes and mind. This energy

is due to super-natural force as that of heat[39]. It has already been pointed out that excessive heat is also the cause of light as observable in red-hot iron. That is why Jaina philosophy puts both the energies under one head – *Ātapa*. As heat is material and atomic, light should also be atomic in nature. *Ṣaṭkhaṇḍāgama*-14[40] mentions it to be a four touch entity. Nyāya school[41] also postulates atomic nature of light though its atom is a large aggregate in comparison to the Jainas.

The corpuscular nature of light has been proved by some effects explained similarly today. The over-powering of low-light objects like planets under sun is one point. The interference or destruction of light is another point to the issue. The image of the object in the mirror is caused by the entry of shadow of the mattergies of the objects into the mirror converting into image by their special capability. It is the fineness of the light particles that they could enter into the hard objects like mirror. The comparison of shadow with air and moonlight with water also indicates their material nature, though the simily refers to the pleasant cooling quality only. The size of light particles is very small in comparison to air and water. Their size and mass could be calculated in a similar way as heat particles. These turn out to be smaller and, therefore, lighter than heat particles (roughly 10^{-42} g. or less). The canons include corpuscles under homologous *Taijasa* variforms like heat.

Many types of light is described in literature as shown below :

(i) General light	a-hot-a-cold light
(ii) Shadow (form of light)	Cold but dark light
(iii) Fire light	Hot and shining light
(iv) Moon light	Cold light

Contrary to common-sense view, the Jaina philosophers point out that sunlight or light, in general, does not help in seeing an object by the eye as there are many birds like cat

and owl who can see even in the dark. This view is not supported by Nyāya school and physicists. The Jainas maintain that the primary cause of seeing a thing is the inner knower, without whom no vision is possible even in the presence of other factors.

The canonical concepts about light and related phenomena are summarised and tabulated in Table 2 alongwith current scientific concepts. This indicates that while some canonical concepts are surprising for their modernity, others seem to be somewhat preliminary in today's contrast.

Table 2 : Canonical and Current Concepts about Light.

	Canonical	Current science
1.	Light forms a category of luminous bodied materials like heat.	—
2.	Light is corpuscular in nature.	Light in wavicular in nature.
3.	It is atomic aggregate in comparison.	It is photonic in 'structure.
4.	It is a form of energy.	It is a form of radiant energy
5.	Light is a sign of livingness.	—
6.	Light could be obtained from two sources : hot (sun) and cold (moon).	Light is obtained from two sources : hot and cold.
7.	Light is over-powered and interfered like sound.	Light is sub-dued and interfered like sound.
8.	Light does not help in seeing the objects through eye.	Light helps in seeing the objects through eye.
9.	Shadow is obtained by obscurance of light. This is also material and atomic.	It has the property of reflection/refraction.
10.	Darkness is opposed to light. One cannot see it or through it. It is atomic.	It is a form of light beyond human visible range (IR/ UV).

Canonical	Current science
11. It should have atomic velocity.	It has high velocity of 3×10^{10} cm/sec. It is the highest velocity.
12. —	Light can pass through transparent mediums (fineness).
13. —	It has property of diffraction
14. It shows five colours/infinite colours.	It shows seven/infinite colours.
15. Light is a four-touch mattergy without mass.	Photon has virtually no mass.

Current Concepts About Light

The physicists[42] have a notion of light as energy. However, current science has passed through many stages about explaining the nature of light. Newton proposed corpuscular theory of light in 1675 with wave-theory being proposed in 1678. This type of nature was confirmed by the phenomena of reflection, photo-electric effects and others. However, electromagnetic rather than mechanical wave-theory held the field until once again the quantum (corpuscular) or photonic theory could rescue the physicists to explain various phenomena un-explained by wave-theory in 1901. Thus, light is now supposed to have dual nature called wavicular rather than corpuscular alone. The energetic nature of light behaves like a wave having a high velocity. Despite non-mention of this aspect of light, the concept of energetic corpuscular nature in canons suggests keen conceptuation power of Jaina seers. The 4-touch aspect of energy forms may be treated as precursor to this partial waval aspect.

The scientists agree to the phenomena of reflection, interference and overpowering of light. The canons presume these as corpuscular while scientists would explain them on electromagnetic waval basic. While canons have only qualitative

mention about them, the scientists have gone highly quantitative in these matters.

The scientists tell us about the origin of light from hot bodies when heat energy converts itself into light energy in the end changing its colours from red to white. In contrast, the light from fire-fly and moon is not originated this way. The radium-dialed clocks, phosphorescent screens shine even in night without feeling heat. This suggests origin of light from cold sources too. Thus, light originates from both – hot and cold sources as the canons proclaim.

Light and/or its obstruction helps formation of shadows and images. The canons have one term for both these effects – *chāyā* or shade. Scholars like Pūjyapāda and Akalaṅka[43] differentiated between the two phenomena. The shadow may be produced by obstruction of light path by opaque materials. The image is produced through reflection at mirror surfaces of passage of light through different types of lenses. This qualitative theory of Jainas is approved by physicists as Jaina has shown[44].

The wave nature of light suggests characterisation of light waves. Each wave has a wave-length and it has a frequency. The visible range of light waves vary between 4000 to 7000 Angstrom units. The velocity of light waves has been the highest 3×10^{10} cm. per sec.[45] which is now under some newer experimentation. The Jaina canons suggest upto 10^{47} cm. per sec. Despite this velocity aspect, wave characterisation is not found in canons.

What is Darkness

There are two terms used for darkness in canons – *tama* and *andhakāra*. *Sthānāṅga*[46] adds two more terms to it – *tāmaskāya* and *mahā-andhakāra*. *Bhagavatī*[47] makes the terms as thirteen in number suggesting different aspects of darkness. Though the dictionary mentions both the above terms as meaning darkness but canons differentiate between them. While the

term *tama* refers darkness due to absence of light, *andhakāra* refers to the absence of sight or defective eye. *Sūtrakṛta*[48] seems to indicate *tama* as deeper darkness. *Bhagavatī*[49] mentions darkness in night due to presence of inauspicious mattergies. It is spread over an area a celestial travels in six months with high velocity. There are eight black hole formations high above the earth in the so-called celestial lands. Clouds and lightenings occur in dark areas. Rainbows also appear there. The colour of darkness is pitchblack and dreadful. It has a blackening lustre.

Bhagavatī[50] also points out that the shape of darkness is like an earthen lamp at the base and it is cage-like at the top. It is a modification of living and mattergy. This canon also mentions many uses[51] of darkness, of course not related to scientific facts. They are as below :

(i) It is useful for giving a surprise attack over the enemies.

(ii) It is useful for keeping the wealth in and for safety.

(iii) It is useful for covering and beautifying the bodies of men/women.

(iv) It is also useful for sex, sports and fun.

In general, canons define darkness as obstructor for vision or seeing objects and opposite of light[52]. It is a separate form of energy different from or anti-thesis of light. This suggests that darkness is a positive existence. Akalaṅka points out that it is not negation but separate entity as it has specific *blue-black colour with other specific qualities*[53]*. However, it is* obvious that one can not see in the dark. But this is not correct to say that there is no light in the dark. The liquid water type nature[54] does not seem to be sustainable as water is too dense and it has partially illuminating quality too contrary to *Bhagavatī* statement.

Scientists tell us that there is light in the dark which has a range beyond human visiblity. This light is sufficient for

some birds to see through it and some cameras have been developed to photograph in dark only. Thus, darkness may be called as human invisible light. Some call it as 'black heat rays'. In this way, darkness is a form of light of specific nature rather than opposite of light. Jaina[55] and Sikdar[56] have also opined similarly contrary to Pūjyapāda. However, Nyāya school[57] defines it in terms of absence of illuminating light which now seems to be a crude definition. Jaina[58] suggests that darkness has a separate existence from visible light, thus classifying light into visible and invisible forms. That is why Jainas have two types of mattergies – sunlight and darkness included in their mattergic forms – all of which are corpuscular.

Currently, it is presumed that infra-red light is present in the dark for which sensitive films have been developed. Chirilian photography has also developed on this basis which pictures the invisible volitional aura of individual confirming the aural concept of the Jainas. These infra-red rays have been fully characterised and they are used in deducing the structure of many complex chemical compounds[59]. We are unable to see in the dark because of incapacity of our eye-camera. Under the current scientific knowledge, the canonical definition of darkness requires reconsideration as per Jaina and Sikdar.

Description of Chāyā or Shadows and Images

The word *Chāyā* has many meanings in Apte's dictionary[60] (shadow, image, reflected image, colour and lustre). They seem to be extension of the main meaning given by Pūjyapāda[61]. He defines *Chāyā* as that which causes the obscurance or obstruction of the path of light. Actually it should mean its formation due to this obstruction by solid or opaque bodies. The canons seem to apply cause into effect secondarily.

The above canonical definition is followed by its two varieties :

(i) A shadow in which colour, size etc. of the object is changed. Whatever be the type or colour of the object, its

shadow in shape is always black, the size of the object varies with the direction and distance of the source of light. D. C. Jaina[62] has called this type as a form of darkness though this shadow is visible. Jaina and Sikdar have overlooked this point. However, *Samavāyāṅga* mentions the change in size of shadow at different times and position of the sun as below[63] :

(a) When sun is north of equator, length of man's shadow is 24 *Aṅgulas* in the first 1/8th of the day.

(b) On seventh day of later *Śrāvaṇa* month, length of man's shadow is 27 *Aṅgulas.*

(c) In the month of *Caitra* and *Āśvina,* length of man's shadow is 36 *Aṅgulas.*

(d) On seventh day of early *Kārttika,* length of man's shadow is 37 *Aṅgulas.*

(e) On 15th day of later *Phālguna,* length of man's shadow is 40 *Aṅgulas.*

If an *Aṅgula* unit of length is taken roughly as equal to 1.75 cms., the above shadow lengths per eighth part of the day during specific times have to be verified. The phenomenon of shadow formation represents indirectly the postulate of linear propagation of light. We can experience this fact through our own shadows in sunlights.

(ii) The second type of shadows are those in which images of the objects are formed. These are called *Pratibimbas* (images). There are two ways of image formation :

(a) Formation of images by reflecting surfaces like mirror. These are virtual and laterally inverted (side-wise).

(b) Formation of images through the interspersion of different types of transparent concave or convex lenses between the light source and objects. The nature of such images depends upon the nature of the lens and their surfaces. The size and distance of the image may vary. The images through lenses are generally known as real. Sometimes they may be inverted also. Cinema screens give un-inverted real images.

It seems that mirrors were known during Akalaṅka days of eighth century A. D. The scholars could see the laterally inverted images in mirrors. The cause of this inversion is said to be the nature of reflecting surfaces. However, its main cause is the linear propagation of light. This is indicative of the fact that this phenomenon was unknown during those days. There is full knowledge about the virtual image formation now and mathematical relationships have been developed for the shape and size of the image at the reflecting surfaces. There are many toys for the children made on this basis. The canonical language indicates that the first type of shadows are equivalent to virtual images as seen in mirrors.

The second type of real and/or inverted images are called only images in literature. But there are no examples of these images. This might be due to the fact that there may not be knowledge of different types of lenses. However, even the foresight of these types of images seems to be a good gesture about the scholars' keen intellectual insight. Now-a-days, magic bouquet and daggers are played with the help of lenses.

The images formed by different reflecting surfaces are given in figures below. The normal shadow can be exemplified by solar eclipse. It is seen that when moon comes in between earth and sun, there is solar eclipse (fig. 1). If the reflecting surface is plane, the image is formed at the same distance behind as the object from the surface. If it is a convex or concave surface, the situation becomes different. With the convex mirror, the image is virtual (fig. 2) while with the concave mirror, it is real (fig. 3).

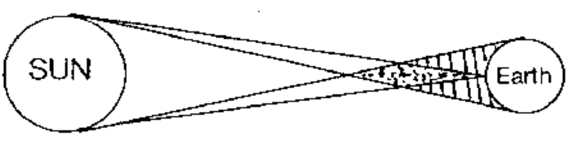

Fig. 1 : Solar Eclipse.

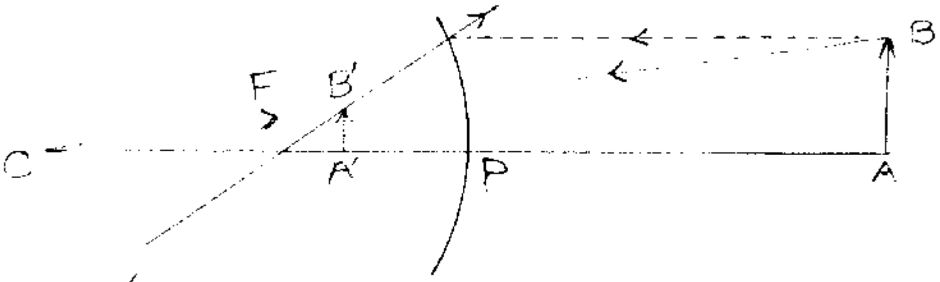

Fig. 2 : Virtual Image.

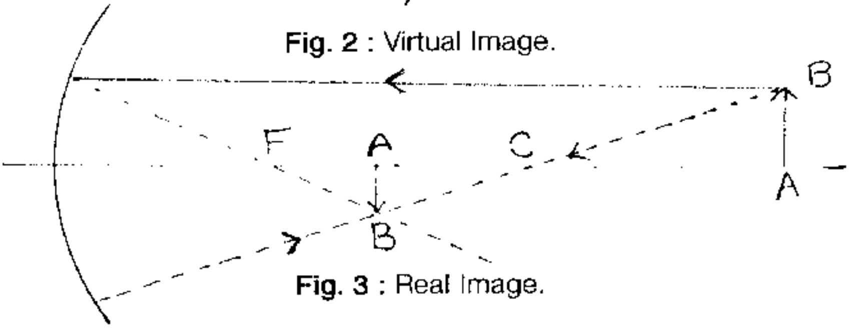

Fig. 3 : Real Image.

The above figures indicate that there are two causes of image formations by the reflecting surfaces – (i) nature of the reflecting surface and (ii) linear propagation of light. We find that canons contain one of the two causes. Secondly, image is just a feeling or visual light effect. It is not actual. Thus, the images' particulate nature does not seem to be reasonable. Sikdar[64] also points out this difference in canonical and scientific contentions. Thus, the cooling shadow of tree or images could be termed mattergic rather than material. Thirdly, shadows must be taken as of different nature from darkness.

Seeing Objects : Theory of Non-contactility of the Eye

It is a common experience that seeing and knowing about an object is a phenomena directly related with light and sense of sight. However, one does not find a reasonable total mechanism about this process in canons. Nevertheless, Pūjyapāda[65] points out that the eye sees only suitably qualified objects which stand in proper direction, distance and illuminated with light without actual contact with it like other senses. He also mentions that all the factors like sense, mind, light and even the object are only efficient causes rather than the immediate ones for seeing an object.

The Prākṛta canonists and Jaina logicians have thought over the working of physical perceptional senses. In contrast with the Nyāya-Vaiśeṣika, Sāṅkhya and Mīmāmsaka theory of sense-matter contact, they postulate that the sense of sight is an exception to this theory (for the Buddhists, the sense of hearing too). They have validated this concept on the basis of (i) canons and (ii) logistics with two different renderings. The canons have a traditional *gāthā* saying that the eye sees the shape and colour of the object without contact with it. *Logically*[66], they hold the view that any or *all* physical factors are inanimate and hence they cannot be immediate cause, but secondary ones, the primary one being the knower soul. This concept of primary and secondary factors for the process of seeing and knowing gives an impression of a bit deeper (and of course, supernatural) insight of Jaina logicians[67]. Their logic has developed over the canonical concept of non-contactility of the eye. It has led to another concept that other senses could also be non-contactile alongwith their prominent contactility[68].

The logic has been developed by eminent scholars like Pūjyapāda, Akalaṅka, Prabhacandra, Hemcandra, Vadideva Sūri and others in their religious and logical treatises during one thousand years from fifth to sixteenth century. Pūjyapāda seems to have initiated the logical treatment, Akalaṅka developed it and Prabhacandra of 11th century completed it by initiating the natural capacity concept. His logistics has been followed by later scholars without much addition. A summary of points supporting the non-contactility concept is given below :

The eye sees the objects without contact with them as[69]

(i) Neither the eye, nor the objects go to each other. They stand at different locations in their own positions. The eye-ball also stays put in place. How, otherwise, its defects could be cured ?

(ii) It works like a magnet attracting iron without contact.

(iii) It sees the objects covered by transparent mediums like glass, mica and quartz etc. Of course, it cannot see objects covered by opaque mediums as light cannot pass through them.

(iv) The eye is motionless. That is why it can see the distant tree and moon simultaneously.

(v) In the dark night, it can see only the neighbouring area round a distant flame and not the objects in the intervening area.

(vi) It does not see the collyrium applied to the eye.

(vii) Far and distant, small or big objects are seen by the normal eye without any difficulty.

(viii) This is the specific nature, functional capacity and power of the eye that supports its non-contactility. It also answers many other related phenomena based on common-sense contactility theory of Nyāya-schools.

Besides the above points, the Jainas have rightly refuted the *Taijasa* (hot shining and ray emitting) nature of the eye held by Nyāya-school[69]. They postulate that neither the eye is hot and shining nor there are rays coming out of it to contact the object. Normally, the *taijasa* light rays of lamp are self-illuminating as well as non-self (object) illuminating. Similar should be the case with eye. However, nobody could see his own eye or collyrium applied to it by self. The rays from the eye are neither visible nor percievable. They do not, therefore, exist. Secondly, if the eye is itself hot and illuminating, there should be no necessity of light or sunlight to see other objects.

Scientific Concepts About Non-contactility

The foregoing summary makes it clear that virtually nothing was known regarding the construction and working of human eye upto the canonical times except that it is the eye-ball which is responsible for viewing the object. That is why

there are many fundamental and unexplained defects in the philosophers' theory of vision related with eye.

Currently, the eye is supposed to be like a camera where there are adjustable pupil lenses (eye-balls) to have images or pictures of the objects on the retina in dark or light to be conveyed to brain for identification. For getting pictures, light is as essential as the object and camera. Due to the difference in pupil lenses in the eyes of cats and owls, they have different powers of sighting. Human eyes work under light of visible range frequencies while the above animals could work even beyond that range.

It is the light which is the contacting agent between the object and the eye. Definitely, there are no rays in or from the eye like the camera. Hence any source of light – candle, sun, bulb etc. can serve the purpose. The light source emits rays passing through or accross the objects while going towards eye to make the picture at retina. These rays could pass through the transparent or transluscent mediums and pass across the opaque objects. This simple mechanism of seeing with eye explains all the points raised for or against the above theories of vision as summarised in Table 3.

Table 3 : Scientific Explaination on Philosopherś Points.

	Philosophers' views	Scientific Explaination
1.	Neither eye nor objects move from their place origin.	It is not required as rays from a light source travelling through or across objects are the actual contacting agents.
2.	Identification of smell etc. by the eye.	They are sensed without light. Eyes have no function for them.
3.	Experience of far and near objects.	The distance is judged by the path traversed by rays coming to the eye.
4.	Doubtful or wrong knowledge.	This is possible due to refraction of rays through rarer or denser medium and defects in the eye.

Philosophers' views	Scientific Explaination
5. Seeing the intervening objects in dark night along with distant burning flame.	It is only the flame wherefrom rays travel to the eye-lenses and not from intervening objects.
6. Inability to see bigger objects.	The rays fall on the eye from small or big objects making their image on retina accordingly.
7. Simultaneity of observing far and distant objects.	It is an illusion. All observations are in succession in small intervals of time due to high velocity of light.
8. Seeing the covered objects.	The eye can see only those objects whose cover is transparent like glass. It can not see objects covered by opaque bodies.
9. Seeing the collyrium or medication to the eye.	There is a least distance for distinct vision for a normal eye. It can not see objects clearly or totally at a lesser distance than this. Applied collyrium comes below this limit.
10. Seeing everything at the same time.	Similar explanation as in 7.
11. Eye is a physical and stationary sense and serves as a factor to see things.	Agreeable
12. Viewing by cats and owls at night.	This is due to different characteristics and visual power of their eye lenses which work in darkness.

It is clear from above that it is not possible to see an object until light-rays of visible range through or across it fall on eye. Thus, despite non-moving nature of the eye, it comes in indirect contact with the object through the light. The word, 'non-contactile', therefore, need redefining as partially or

indirectly contactile rather than its complete negation. The letter 'a' has many meanings including partial aspect. This will make the Jaina description more in tune with current scientific theory. It is also surmisable that the points mentioned in Table 3 lead us that while the Nyāya school is right in :

(i) postulating the part played by rays and light in observing the objects.

(ii) and holding simultaneity of observations as an illusion, the Jainas are also right in :

(a) discarding the firy nature and rays from the eye concept of Nyāya school and

(b) introducing the capacity concept in cognitive senses.

However, the Jainas do not seem to be right in postulating the secondary nature of light rays in viewing the object and refuting the solar rays in night[70]. It seems that both the schools had no proper idea about the following phenomena associated with light :

(a) Proper structure and functioning of the eye.

(b) Concept of least distance for distinct vision.

(c) Very high velocity of light.

(d) Rectilinear propagation of light.

(e) Many other newer phenomena like refraction, diffraction, Photoelectric and Compton effects etc. and interchange of energies.

The Jainas have an undefined capacity concept involving many of these phenomena indirectly. Despite this, the deep intellect of Jainas led them to develop capacity concept of unique distinction through which they could have some contemporarily advanced observations as below :

(i) They could explain seeing objects through transparent mediums.

(ii) While refuting the firy nature of the eye, they have exemplified many qualities of gold, hot water, gems, ice, etc.

(iii) Iron-attracting power of natural magnets, serpent-attracting power of incantations and use of rotators.

(iv) Non-observation of intervening objects and applied collyrium etc.

The above comparative desription leads us to judge how much the current knowledge has developed qualitatively and quantitatively over the canonical and logicians' periods in this regard. This enables us to think about composing twentieth century new canons.

Colours

Jainas call mattergy by the term *'rūpī'* which means it is sense-perceptible. It has a set of four inseparably co-existing qualities of touch, taste, smell and colour including shape. Thus, colour is one of the fundamental qualities of mattergy. It refers to two meanings, the colour and the shape of the coloured. It is obvious that the eyes and light are responsible for the sensation of colour and its shape. Thus, colour is also a phenomenon associated with light.

The early canons like *Sūtrakṛtāṅga*[71] and *Samavāyāṅga*[72] mention the colours on the basis of common examples like golden (yellow), fire (red), light beam (white), pigeon (black or grey), peacock-neck (blue), parrot neck (green), divine (ash-grey), saffron (yellow), tail of blue pigeon (green) and the like. Despite the fact that rainbow colours are taken to be seven, volitional aural colours are taken as six, the canons agree with five colours. Most canons do not mention much about how colour sensation is felt.

Normally, colour is mostly objective depending upon structural units of the objects, though some subjectivity may also be involved in it. Recently Muniśrī[73] Jain[74] and Jain[75] have thrown some comparable light on this matter pointing out two facts :

(i) There are only three basic colours – blue, yellow and red approved by science. The rest two may be called so only empirically.

(ii) A. K. Jain has suggested that the three basic colours refer to the colours of the atoms or sub-atomic particles only and not to their aggregations. Thus, aggregations may have any number of colours, infinite in number. This has been discussed under general properties of matter in an earlier chapter.

The above description about the canonical contents of light indicate that there is sufficient observational record about many light associated facts and phenomena. There is some attempt regarding theorisation on many observations. This seems to be highly qualitative and intellectually logical. However, there is no doubt that most of the canonical matter is ahead of contemporary postulates on the subject. The summary of current knowledge in this regard gives us an idea about the advance man has made over the canons. This fact, once again, leads us to study canons with historical rather than absolute perspective.

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Chapter 11

Content of Physics - 2 : Sound, Electricity and Magnetism

[A] Sound

The canons and commentaries contain large amount of material regarding sound – a term which includes its nature, forms like letters, words, speech, language, notes and tones of music, its attributes and propagation. It has been described by the terms – *śabda, vacana, bhāṣā* and *dhvani* in canons. These are closely related terms but often taken as equivalents. The canons indicate many terms associated with *bhāṣā* (language or speech) :

(i)	*Bhāṣā-dravya*	Bhāṣic matter
(ii)	*Bhāṣā-vargaṇā*	Bhāṣic variforms
(iii)	*Bhāṣā-paryāpti*	Bhāṣā completion
(iv)	*Bhāṣā-samiti*	Bhāṣic carefulness
(v)	*Bhāṣā-vicaya*	Bhāṣic meditation[1]

There is mention of two terms associated with *śabda*, *Śabda-naya* (verbal stand-point) and *śabda-kāma* (wish-provoking sounds)[2]. The standard scientific term for *'śabda'* is sound. *Dhvani* is another term for sound and it is clear that this is more basic as no pronunciation of words is possible without it. There has been science of sound or acoustics for literary authors and musicians since early times in India and canons also have description about it with good details.

The early canons use the term *'śabda'* without any inner details about it. Of course, they mention its various effects as below[3] :

(i) Sound may be pleasing, desirable or otherwise.

(ii) Sound may effect psychologically.

(iii) Sound excites enjoyment.

(iv) Sound makes heart stirring and thrilling.

(v) Sound provokes desires.

(vi) Sound makes one sleep or awakened.

Sūtrakṛta mentions some types of sounds like thunder-clouds and words under pains and sorrow. Its *Cūrṇi* mentions the motion of sounds throughout the world[4].

Sthānāṅga, Bhagavatī and *Prajñāpanā* have given more details about nature, propagation and classification of sounds observed. This is still maintained with some modification. *Sthānāṅga*[5] mentions that sound is produced by three methods :

(i) by conjuction (beating of drum).

(ii) by disjunction or splitting (splitting of bamboos).

(iii) it can be produced from part or whole of the body.

In contrast, Kundakunda[6] mentions sound as being produced by the atomic aggregates without mentioning the method. He opines an atom as soundless. Could this fact reflect on the period of Kundakunda before *Sthānāṅga* was compiled ? The Vaiśeṣikas[7] have a fourth method producing sound by sounds themselves as in echoes and recoils.

Sthānāṅga[8] also gives ten varieties of sound and their classification in different categories as shown in Table 1. The following are the ten varieties :

(i) Bell or announcing sound

(ii) Small or big drum sound

(iii) Splitting sound (bamboo split)

(iv) Rough sound (crow sound)

(v) Stringed instrumental sound (violin)

(vi) Loud sound (thunder)

(vii) Fine/low intensity sound (lute)

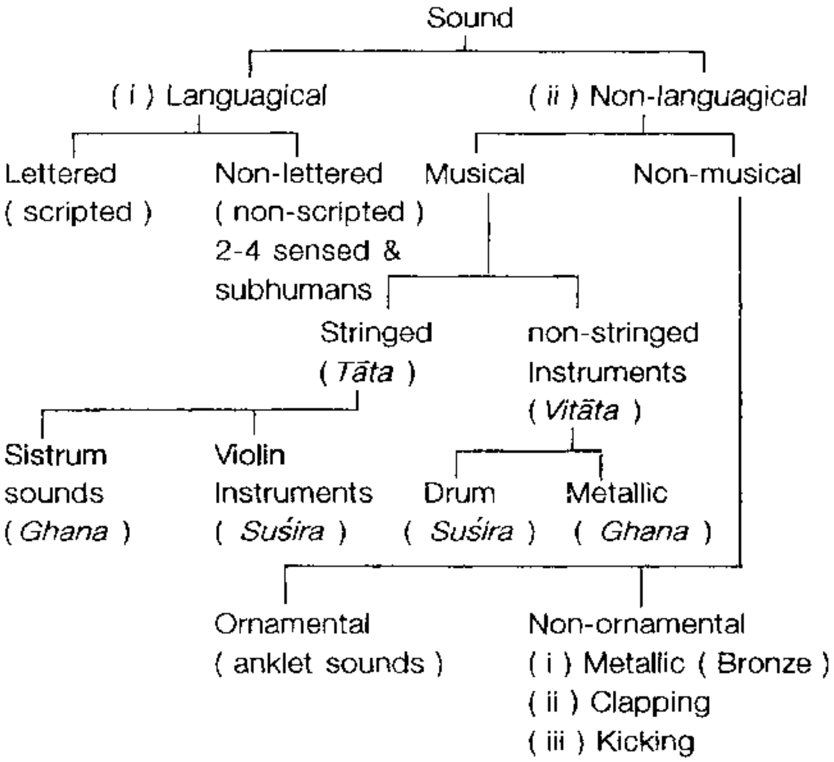
(viii) Combined sound (archestra)

(ix) Throatal music (kakini or cuckoo)

(x) Small bell sound (deformed)

These are the different forms of sound and included in Table 1.

Table 1 : *Sthānāṅga* Classification of Sounds.



When one looks at the later literature[9], one finds that this classification is modified to avoid duplication. There also seems some difference in the meaning of some terms as below :

Term	*Sthānāṅga*	Pūjyapāda
Tāta	Musical sound due to stringed instruments (Lute, Violin etc.)	Musical sounds due to stretched membranes (Drum)
Vitāta	Musical sounds due to non-stringed instruments	Musical sounds due to stringed instruments
Ghana	Metallic sounds (sis-trums/cymbals)	Striking (metallic) and reed instruments (Harmonium etc.)

Suśira	Wind instruments & stretched membranes (drum & flutes)	Wind Instruments (pipes & conch etc.)

There are other classifications mentioned by *Umāsvātii* in *Bhāṣya,* Pūjyapāda, Akalaṅka and other later scholars. The earliest one seems to be in *Bhāṣya*[10] with six classes of sounds – five of non-languagical type including collisional sound and the languagical being the sixth – no classification like *Sthānāṅga* or Pujyapāda type. This is based on the method of production of sounds. The sound may be produced naturally (thunder, electric lightning etc.) or by effort of different beings. The languagical sounds are all by effort while the non-languagical ones may be of both types. Pūjyapāda classification is summarised in Table 2. This seems to be more general and condensed. This is mostly found in Digambara literature. It is seen that this classification eliminates an inter-classification of *Sthānāṅga,* thus, giving an independance for some classes. Similarly, the ornamental and non-ornamental classes seem to have been merged in other varieties. Thirdly, if Mahāprajña commentary[11] is taken into account, there seems to be no inclusion of sounds produced through air columns (flute, conch etc.). Rampuria[12] has pointed out the difference of opinions about the meaning of the term *suśira* (air column or metallic sounds). The Pūjyapāda classification eliminates these discrepancies by clearcut definitions.

Rampuria mentions an another classification, also based on source. Accordingly, sounds may be (i) due to living (language), (ii) non-living (thunder, lightning etc.) and (iii) mixed sources (conch, flute etc.). This seems to be quite preliminary classification of historical interest only.

Akalaṅka[12] has given a little deeper two-fold classification of languagical sounds : (i) Physical and (ii) Psychical. Both are said to be mattergic arising due to specific kārmic fruitions. The physical language is generated due to psychical

form. Yaśovijaya Gaṇi[14] has given a three-fold variety of physical languagical sounds : (i) acceptable by self (ii) emissible by self or others and (iii) impact producible.

Table 2 : Classification of sound by Pūjyapāda.

Sound

- (i) Languagical (by effort)
  - (a) Scripted or lettered
  - (b) Non-scripted (Non-lettered)
- (ii) Non-languagical
  - By effort
    - (a) Stretched membrane sound
    - (b) Stringed instrumental sound
    - (c) Metallic & Reeds sound
    - (d) Air column sounds
  - Natural
    - Thunder, Lightning etc.

Prajñāpanā[15] also has a two-fold classification in terms of developed and undeveloped speech with many subclassifications.

Nature of Sounds

Bhagavatī and *Prajñāpanā* are the most important canons to learn about the nature of sound in nutshell. Later scholars begining from Kundakunda, Pūjyapāda, Akalaṅka, Haribhadra, Vidyānandi and Prabhācandra have contributed to the logistics to support the canonical statements – specially regarding the material nature of sound and its relative eternal-cum-non-eternal nature. The following points have been mentioned in canons in this regard :

(i) Sound is one of the modifications/effects of non-living mattergic entity.

(ii) It is itself material and non-living.

(iii) It is a four touch (hot-cold, positive-negative) entity. Thus, it seems to be massless. However, it is in the form of aggregates of infinite mattergic entities[16].

(iv) It is fine-gross class of atomic aggregates which is non-perceptible to eye but perceptible by the ear-sense of hearing.

(v) It consists of similarly grouped aggregates (Vari-forms) called *Vargaṇās* (9th out of 23) – the aggregate being larger than light energy.

(vi) It is not subject to full knowledge and full visibility by the common man.

(vii) The sound aggregates are pervasive throughout the space. The body first acquires them in the first instance from all directions (six) and the speech comes out in the second instant. Thus, it takes two instants of time to speak.

(viii) The sound mattergy is received by the body successively with or without interruptions.

(ix) The sound is heard by ear-contactility. Nearer sounds are generally heard (because of the capacity of the ear and intensity of sound aggregates).

(x) The basic source of sound is the living entity where it is produced by variety of actions in different parts of the body involving palate.

(xi) Sound is called language while speaking, neither before nor afterwards.

(xii) The sounds are sometimes split or broken into different species of letters and words while speaking and sometimes non-split or unbroken (gross) depending upon the speakers. However, the initially non-split sounds undergo split after sometime during their movements.

(xiii) The speed of sound depends upon the mattergic fineness, speakers efforts and association with medium particles.

(xiv) Sound has a motion and it can go upto the end of the universe.

(xv) No two languages can be spoken simultaneously by every being.

(xvi) Sound has a shape of thunderbolt.

(xvii) Languages have two forms : (i) understandable and (ii) non-understandable with many varieties in each class.

(xviii) It could be classified in many ways as already detailed.

(xix) Sound can be produced by conjunction and disjunction of material bodies. *Ṣaṭkhaṇḍāgama* mentions a mixed process too for its production.

(xx) Sound has a two-fold nature. Substantively, it is eternal and modally it may be non-eternal and momentary.

The above canonical concepts suggest that sound is a form of energy rather than normal tangible matter. Its aggregates are eye-imperceptible and possess imperceptible colour, taste, smell and touch because of fineness and dormancy. Many later scholars have observed additional phenomena about sound and they have proved material nature on the following grounds :

1. Sound is material because[17] :

(i) It is received by material objects like the ear drum.

(ii) It is obstructed and repulsed by material objects like wall, dry leaves and opposing air.

(iii) It is overpowered by higher intensity sounds.

(iv) It is interfered by many objects.

(v) It is the effect of material entities and moved by air in all directions like cotton.

(vi) It is produced by variety of actions and disturbances in material objects like those in heart, throat, tongue, teeth and palate etc. It produces changes in these organs like eating a medicine.

(vii) Vibrations are produced in material objects when sound is produced from them as when beating a drum, tuning a fork or ringing the bells.

(viii) High blowing conch sound has sometimes a deafening effect.

(ix) Echo is produced when sound is struck by solid walls or objects.

(x) It has qualities of compression, rarefaction, weak-

ening, intensification and even destruction under different circumstances besides other qualities already mentioned in (i-iv).

(xi) It is active and it moves in air in all directions with different velocities. Its maximum velocity is said to be larger than normal light.[18]

(xii) It has qualities of being slow and loud, small and large. It has touch, numericality, quantitativeness, conjunction and concussion.

The above points indicate that as a rule, matter effects matter only. The Jaina logicians have observed many properties of sound studied in current days to prove its material nature. The above points also substantiate the definition of mattergy to apply to sound with its properties of action and perceptibility by external sense and eternal-cum-non-eternal nature. This seems to be quite a good advance over canons.

Indian Schools of Thought on Sound

The above canonical and post-canonical conceptions about sound seem to be realistic and represent a synthetic approach about many of the postulates in other Indian philosophies as could be inferred from Table 3. It could be seen that eternalist Mīmāmsakas stand on the one end (substantiality later a quality, eternality, formless, oneness) while Vaiśeṣikas to be on the other extreme (quality of space, non-eternality, form-lessness, multiplicity). By defining a reality as having qualities and modes, Jainas have postulated sound as a manifestation of matergic reality. They have maintained a single term *'śabda'* for it in contrast to the three terms —*dhvani, varṇa* and *śabda*— of the Mīmāmsakas The Jainas point out that these terms connote the same meaning as sound, different from words can not be proved. The Vaiśeṣikas have followed Jainas in this regard.

There seem to be four important points of consideration :

(i) It is a quality and/or menifestation of reality.

(ii) It is perceived by ear.

(iii) It is produced by collisive vibrations in materials.

(iv) It travels in the medium (air in general).

The Mīmāṁsakas assume words as permanent, otherwise how they could have constant meanings ? Kumārila's logistics in this regard has been tabulated in Table 3 with their counter-arguments from Nyāya-sūtra[19] and Prabhācandra[20]. It is seen that the latter did not only utilise the arguments of the earlier but has added many more to them to show that the eternalists are not on an all-proof right track in the light of many similar phenomena exhibited by the non-eternalists too, proving thereby the non-eternality of words. Mīmāṁsakas believed words to be non-corporeal but later ones have professed them to be the quality of space as the Nyāya school[21]. This brings them nearer to Vaiśeṣikas. It is, however, important that the logistics on both sides is partly factual and mostly intellectual deliberations. The Jainas seem to be somewhat advanced in this regard.

Table 3 : Logistics of Mīmāṁsakas, Nyāya-Vaiśeṣikas and Jaina School on Eternality and Non-eternality of Sound/ words.[22]

Mīmāṁsakas	N. V. and Jaina Schools
1. Words are eternal.	Words are non-eternal.
(I) Vedas declare them to be eternal.	—
(II) The knowledge about meaning of words is, otherwise, not possible.	The knowledge about meaning of words could also be possible with their non-eternality concept as with relationship of non-eternal entities like smoke and fire because of similarity.
(III) The eternality could be proved by many types of	

Mīmāmsakas	N. V. and Jaina Schools
cognitions of validity (*Pramāṇas*) like	
(i) Recollection	
(ii) Recognition (proves similarity and unitary character of words)	Recognitive similarity does not prove unitary character as they are produced by palatal efforts etc. at each instant like recognition of lamp etc.
(iii) Inference	
a. Sound is eternal as it is related with ear or subject of sense of hearing.	
b. The same word under different conditions has the same meaning and pronunciation.	
c. Expressed word is related with its meaning.	
d. Time is never devoid of words as they are related with timeness.	This reason could go other way too with respect to light and electricity which are non-eternal.
e. Words are supra-sensory.	Not agreeable.
(iv) Direct Perception It is directly experienced by sense of hearing.	Direct perception also contradicts eternality and unitary character of words.
(v) Implication *Words are eternal*, otherwise how their meanings could be learnt ? The apparent sameness in words shows their unitary character rather than expressed one. It	

Mimāmsakas	N. V. and Jaina Schools
may cause illusion. There is no real sameness in words. Sound becomes apparent by implication. Words, ears or both are refined by sounds.	
2. Words are expressed/manifested rather than produced. Palates etc. and sounds are manifesting agents rather than producing hearing.	Words are not eternal as otherwise, (i) They should always be heard as there seems to be no visible cause of their non-existence. (ii) Expression of words at one place or time should lead to their expression at all places and times. (iii) Because of same-sense receivability, all the words should be heard simultaneously at all places by all people leading to their non-meaning. (iv) There is no rule that manifestable is always manifested by agents. This suggests non-omnipresence of words. (v) Sounds are the same as words. (vi) The manifestational flaws could be avoided if the agents are treated as sound-producing agents.

	Mīmāmsakas	N. V. and Jaina Schools
		(vii) There can be no expressed-expressibleship or obscured-obscurableship under the concept of eternality.
	The words are not always heard due to the absence of co-operating causes.	(viii) The concept of manifestation does not stand logical scrutiny.
3.	The words are eternal as they have non-touchability like space.	The logic is inconclusive as actions and atoms are non-eternal despite their non-touchability.
4.	The words are eternal as they are bestowed and practiced by and through the teacher to the taught.	This logic is not practically substantiated due to the absence of words during the interval of reach and formalisation of practice.
5.	Sound is eternal as there is no visible cause for its destruction.	The cause of destruction of sounds is observable in the form of succession and hindrances in the path which is a common experience.
6.	The componentless space is the inseparable cause of sounds. This proves its etrnality and pervasiveness.	The space has apparent component, as it covers space between interrupted lands.
		Words are non-eternal as (i) it is directly perceivable by a sense and a specific quality of the pervasive reality. (ii) it is produced through wave-motion type mechanism. (iii) they are effects because

Mīmāṃsakas	N. V. and Jaina Schools
	they are produced by efforts of different parts of the body.
7. They become unmanifest rather than destroyed before or after the pronunciation.	(iv) They do not exist before or after they are pronounced. There can be no obscuring agent for eternal and pervasive entity. One must accept the concept of prior and destructional non-existence in this case.
	(v) They are receivable by ears.
8. Humans only manifest them.	(vi) The human sounds are individualised ones.
9. Words are not many. It is just an illusion like experiencing many suns in water pots or different places.	Many peoples listen to the same words at different places indicating manyness of words.
10. The words are not deformed, they are replaced by others.	The words are transformed/ deformed grammatically.
11. The sounds have no qualities as they are eternal. It is only a sounding effect.	Sounds have qualities of loudness etc. which could be refined or modified.

Nyāya-Vaiśeṣika school is, on the other hand, on the other extreme. They postulate it as non-eternal one and not mattergy but quality of the reality called space. It is perceivable by sense of hearing, destructible by cause and effect, productible by similar or dissimilar concussion, disjunction and by word themselves and part pervasive[23].

The Jainas represent the third school. They refute the first two postulates of Nyāya school. Firstly, they do not agree words to be quality of space which is non-corporeal. For them,

it is a form of mattergy and it has manyness. Secondly they do not agree to permanent non-eternality of words. Their material nature imposes upon them basic permanence with changing qualities. The arguments and counter-arguments in this regard are tabulated in Table 4 where, again, we find that percievability and various qualities dominate the field of logic. They have given six-fold arguments that as the words can not be the quality of tactile substances, they must be quality of space. The Jainas, on the other hand, argue that :

(a) Words are material because they contain many qualities.

(b) They are substrates for many realities like us.

(c) The space qualityship is proved to be inconclusive with the examples of air, taste etc. which are contactile qualities. The words are with form and movements.

(d) The words are not totally permanent.

Table 4 : Supporting and non-supporting logistics regarding mattergic nature of sounds/words[24].

N. V., Mimāmsaka School	Jaina School
1. Word is not a reality as	Word is a reality as
(a) it is substrate of a pervasive reality (space).	It is not a substrate but a substratum of many qualities like touch, slowness, loudness, numericality, conjuction etc.
(b) it is substrate as it is perceived by an external sense.	The reality can also be perceived by external sense.
(c) It is not action as it does neither cause conjunction/ disjunction nor it is eye percievable despite its non-eternal nature.	It does have action or motion despite its non-livingness.
2. The word is a substrate as it is a quality like colour etc.	See (a) above. It is also dependant on many realities.

N. V., Mīmāṁsaka School	Jaina School
3. (i) Word is a quality of space reality as	Words are not quality of space but a reality (mattergic) by themselves.
(a) They cannot be the quality of touchables as they are directly percievable while the words are not.	Agreeable
(b) It is produced with space as its inseparable cause.	It cannot be so as words are not its quality.
(c) They do not last until their substratum.	Agreeable (It proves their non-eternality too).
(d) It is percieved away from its substratum like drum, conch etc.	Drums etc. are not its substratum but instrumental causes for producing it which is heard at a distance.
(e) It is percieved by nearby persons and not by distant persons.	The perception is not the effect of space qualityship but it depends upon its nature of origination.
(ii) It is also not the quality of realities like soul, mind, direction as their properties are different.	Agreeable
(iii) By remainder, it is a quality of space.	Not agreeable
4. Words are non-mattergic as they are quality.	The logic is inconclusive. The sounds may not be percieved like space.
5. Words are non-mattergic as they are quality of non-mattergic space.	The logic is inconclusive. The sounds may not be percieved like space.

N. V., Mimāmsaka School	Jaina School
6. Words are non-mattergic as :	
(i) they are non-percievable by sight etc. like pots etc.	The words have unmanifested and fine form, hence, not percievable like smells etc.
(ii) Sounds have no perceptible form.	One does not percieve even forms of dyads etc. though they exist there like hot water or eye-rays.
(iii) The words have no extension, throw, air impelling, motion, collision, subduation, resistance etc.	The words have all these properties of common experience.
(iv) The ears of listeners are not filled with material words when hearing.	It does occur but not felt because of fineness.
(v) The words are heard by other persons when one is hearing them.	They are heard by many persons because of their manyness, fineness and motion.
(vi) There is no visible cause for their destruction.	There are many obvious causes for their destruction.
(vii) The sounds are non-touchables.	The sounds have touch *experience when they are* pronounced loudly or when gun-firing or lightning etc. takes place. Their obstruction and subduation also prove their touchability.
(viii) The sounds pass through non-porous bodies.	*The word 'non-porous' should* mean finely porous. The fine sound-particles can pass through (or get absorbed) in

N. V., Mīmāṁsaka School	Jaina School
	such mediums. They recoil from perfectly non-porous mediums producing echoes.
(ix) The sounds are produced through wave motion-like mechanism.	The wave-motion mechanism may lead to absence of motion everywhere.
	Wave motion mechanism can neither produce another single word nor many words. It indirectly proves motion of sounds.
	Space should have components in this mechanism. Words are produced or deformed by material bodies, due to vibration.
	They require medium for propagation.

The logic of table 4 also subscribes to the remark for Table 3. In addition, the Jainas have also refuted the wavelike transmission ideas of the Vaiśeṣika[25]. They travel by themselves as well as with the help of air in all directions. If they are quality of space, it should be all pervasive, inactive and imperceptible. It should either be always heard or not heard at all. The Jainas also find Buddhist conception of permanent momentariness of words as untenable.

It may be presumed that space exists between the earth and planets. Its all-pervasiveness may be equated to the atmosphere surrounding us. The air or other gases contained in it are responsible for propagation of sound. Thus, if one equates the space of canonical era to the present atmosphere, it becomes clear that there arise waves, like water, in space

during sound production and they travel to our eardrums which vibrate and produce sensations of sound. Different sounds have differring vibration frequencies, hence identified differently. Thus, atmospheric space becomes an essential part to propagate sound. The Nyāya school, thus, seems to have taken the propagation medium as the source of origination of sound.

The definition of space is nearly similar in both the philosophies. On the basis of the theory of like produces like, the non-material space can not produce material sound. However, if non-material nature means energiness of sound, the philosophical theory may become better scientific as will be shown later.

Jaina Postulates and Scientific Theory of Sound

Physicists have studied large number of facts about sound during the last two hundred years. It will be interesting to see how far our canonical concepts move with them. This will be described under five main heads :

(a) Nature of Sound

Physicists tell us sound as a form of mechano-kinetic energy produced due to vibratory motion of molecules above a threshold. This energy has wave-length greater than heat or light waves[26]. It might theoretically be logical to presume energy as basically material in the Einsteinian days, but there is a clear difference between common material and energy. It is normally imperceptible and inferred by its effects. The weight of energy is so small as to call it weightless, and hence formless, and non-material. Actually, it has been shown to be wavicular by nature as has already been described in other cases. Secondly, energy is a symbol of action and motion with its two varieties – potential and kinetic, sound being a form of kinetic energy. Thus, to call sound as material – is just a question of reference to the definition of matter and energy. All forms of energies of today were supposed to be material upto Newtonian age irrespective of their dimensions. Einsteinian theory abolished the

distinction between them. On this basis, the Jaina material view of sounds and refutation of its wave-nature represents the classical physics though postulated some 2100 years ago. The 4-touch atomic aggregate nature of sound by Jainas stand on a firm footing even today. The Vaiśeṣika non-materialistic and wave-like propagation postulate about sound seems to be somewhat post-Newtonian in approach. The current scientific view seems to synthesise these two viewpoints though holding more towards waveside. That is why they have mathematicised the science of waves and wave-fronts[27]. However, for a common man, Vaiśeṣika view seems to be more intelligible as he is not in a position to realise the finer dimensions of energy particles. The Sāṅkhya's infra-atomic (*tanmātrika*) view of sound also falls in this category.

Very little is said about the detailed nature of sound in other Indian philosophies like its fine-gross and atomic aggregatal nature. The Jainas presume many qualities of non-perceptible nature in sound but not non-existing. Some of these qualities of materiality are not substantiated by physicists (like thunderbolt shape etc). However, they point out that sound particles (waves) have larger wavelength/size than light particles. The amplitude of sound waves varies between 10^{-9}-10^{-2} cm. and its wavelength varies between 0.3 to 3.0 meters[28].

Many Jaina concepts are agreeable to physicists where they have quantitative aspects in many cases. These include almost all properties mentioned in earlier part of this section. The facts enunciated for proving materiality of sound are also aggreeable to the physicists. However, they have added some more to them like refraction, diffraction, beats and resonance, ultrasonics and interconversion of sound in different energies which have proved a boon to modern civilisation.

(b) Generation of Sounds

The physicists agree to the four canonical methods of sound generation in a qualitative way. However, there seems to be no mention about vibrations being produced in sounding

bodies until 14th century A. D. when Guṇaratna Sūri pointed it out in his commentary on Haribhadra Sūri's noted work – *Ṣad-darśana-samuccaya*[29]. However, it is mentioned there in connection with proving the material nature of sound. It seems there that sound produces vibrations which is scientifically just the other way. Vaiśeṣikas also talk about vibrations but its relation to sound production is not clear. Śrīdhara Bhaṭṭa of 10th century[30] and Śaṅkara Miśra of 15th century[31] state about the loudness and intensity of sound but they also do not mention about vibrations in sounding bodies. However, they tell about continuous flow or motions of sounds through air to the ear drum.

Acousticians have demonstrated that collisions produce vibrations, their strength being dependant on energy of collisions. Not all vibrations but a range between 2-3000 produce audible sound. Higher range tend to disrupt our auditory mechanism. Human ear is sensitive to audibility in the range varying between 20 to 20,000 cycles per second. This range has sufficient energy not only to cause sound sensation in ear but to deafen it too[32].

The acousticians have analysed the sound producing vibrations and characterised them. This has given them the capacity to control over the sound one likes.

(c) Propagation of Sounds

The acousticians accept propagation of sounds. However, the Prākṛta literature mentions only air (and space too for Vaiśeṣikas) as a medium which is a mixture of gases. The physicists state that not only gases but liquids and solids also serve as the medium for propagation. They tell us that these two are better mediums as sound travels faster in these two by 4 to 10 times (330-3000 meters/sec.) in comparison to gases. The sound recoils from smooth surfaces and absorbed in porous surfaces[33].

The mechanism of propagation of sound is found to

be different in various Indian philosophies. The Nyāya-Vaiśeṣika school (app. 300 B. C.) presumes that the original sound *produces a series of sounds in space in all directions like waves* in water or concentric petals in flowers to be heard by various people at different distances until the sounds die out due to collisions with obstacles[34]. In contrast, the Jainas have a different mechanism based on their materialistic theory. They believe, when material collisions take place, sound particles are shot-off with differing velocities in all directions. These particles travel long distances coupled with their associations with air which also induces their motion. Of course, sound dies for the Jainas the Vaiśeṣika way. It has already been told that Jaina sounds may travel to the end of the universe[35] and their velocity may be sometimes faster than light despite their particles being larger. They may move in continuous or broken form and linearly, circularly or in curved line[36].

The physicists believe that due to kinetic energy associated with sound, successive motions are produced in the medium in the form of longitudinal (concentric flower petals) or transverse (ripples in water or air) waves moving in all directions until receptors are available. Thus, sound energy is medium or air born during its propagation. This mechanism suggests an apparent equivalence with the Vaiśeṣika school with water wave theory. However, this should mean contradiction with Jaina view. The wavicular nature of energy suggest sound to be cluster of fine energy particles behaving like waves not explicitly expressed in canons. However, it could be inferred from this type of nature.

While the Vaiśeṣikas do not mention about the velocity of sound, the Jainas have made two statements about it as pointed earlier. The first of them may be acceptable to the scientists of today (which is regarding the limit of motion). The second postulate of faster than light velocity seems to be an speculation looking to the fact that its velocity in air is 330m/sec. in comparison to 3×10^8 m/sec. for light. Secondly, it

seems surprising how the fact of seeing light first and listening sound later could not be experienced in early days by the insighted scholars ? Thirdly, the normal velocity (maximum) of heavier particles can not be larger that lighter particles. This maximum velocity statement, therefore, requires reconsideration or substanciation. It is a different thing that sound converted into electricity travels with the speed of light.

(d) Quality of Sound

Besides many properties of sound, Prabhācandra[37] has mentioned some qualities of sound with proof. They are :

(i) Touch (obstruction and collision effects).

(ii) Short and long or soft and loud sounds.

(iii) Intensity.

(iv) Numericality (number of sounds).

(v) Receptacle for concussion.

(vi) Motion and echo.

Various touch effects are confirmed by scientists from the early days of studies on sound. The sounding bodies do vibrate causing vibrations in the nearby material medium. It is this medium which touches the neighbouring molecules successively causing them to vibrate to produce sounds further when they are in the audible range. The weakening or collisions of sounds are also due to medium resulting in reduction or increase is vibration energy or velocity resulting in the corresponding sound effects. It seems, therefore, that the Jainas have superimposed the material nature of medium on sound as seems to be more tangible to the common man. Moreover, even if sound is assumed material, its fine particles should have elastic collisions which will not have enough energy to produce sound sensation. However, wavicular nature of microparticles has improved the canonical view-point to some extent.

Though canons mention the qualities of intensity *(I) and loudness (L) separately, but there seems to be no* clear definitions for these terms. The laymen take them as equi-

valent. The physicists have distinguished them even mathematically. The intensity is defined as the amount of energy transferred to the medium per unit area by moving waves, or

$$I = e\,v \quad (\,e = \text{energy density};\ v = \text{sound velocity}\,)$$

In contrast, the loudness, L, of sound is a feeling depending upon the sensitivity of the ear. Thus, while intensity is a measurable quality, loudness is not. However, a relationship between the two has been developed as

$$L = K \log I$$

suggesting that doubling the intensity does not lead to doubling the loudness.

Besides, the scientists have added two more qualities to sound —— pitch and timbre or quality. Pitch measures the sharpness or flatness of sound and dependant upon the frequency of waves independent of intensity. The quality called timbre measures the purity of and overtones in sounds. These qualities are meant for distinction and identification of different sounds. They do not find mention in canons. Per chance, the intensity term of canons covers both these qualities in their wider sense.

The numericality and receptaclity of sounds is a common experience without any dispute. The first one relates to the number of sounds varying between one to innumerable in comparison to Mīmāmsakas one sound. The quality of substrateness for concussion etc. may be taken as superimposition of quality of medium causing strikes and counterstrikes.

The scientists have not only agreed to sound motion, but also have characterised it by simple harmonic motion as in pendulum of clocks for which they have developed sound mathematics.

(e) Classification of Sounds

Different classifications of sound by Jainas have already been given earlier. It seems that this is sufficiently advanced over the Vaiśeṣikas who have only non-detailed two-fold one-

lettered and non-lettered (where drum sounds are given as an example. It may cover musical sounds and noises too, it seems, as there are mention of lute, flute, etc. instruments at many places). The earlier Pūjyapāda classification is sufficiently supported by physicists of today as far as non-languagical or musical sounds and noises are concerned. The musical sounds are produced exactly by the same four methods, i. e., (a) stretched membranes, (b) strings, (c) rods and plates and (d) air columns as mentioned by Pūjyapāda. However, the noises may not only be natural, they may be man-made also. The languagical sounds, per chance, do not find place in physicists classification. Sikdar and others do not seem to be justified when they call languagical sounds as to be included in current noises, these being defined as undesirable by recipients. Table 2 indicates that humans, 2-4 sensed beings, subhumans and omniscients have languagical lettered or non-lettered sounds. The term language is defined as meaningful words and sounds. They must form a separate class. It is therefore clear that classification of table 2 is wider in scope than the scientific one. It includes languages and non-human sounds too.

The Jainas have classified languages and speeches too in *Prajñāpanā*[38]. The language is a means to express number, gender, tense and sense and it could be true, false, non-true-false and non-true-non-false. It could be purposeful, awakening and deawakening towards salvation path. *Sthānāṅga*[39] and *Anuyogadvāra-sūtra*[40] delve deep into music septat and its details. It is said that there are seven primary notes derived from the efforts of various parts of the body as shown in table 5.

Though the music details belong now to musicology still the basics are described under sound. The septat is accepted by scientists but canonical details about it in Table 5 are interesting for the music specialists. They require confirmation from the singers themselves as these must be traditional in canonical days.

Table 5 : Music Septat by Jainas.

Name	Living Sources	Sources	Nature	Point of Origin	Qualities
1. Six organ derived	Peacock	Drum special	fortunate	front tongue	Eight qualities
2. Bull-type	Cock	cow-mouthed instrument	prosperous	chest	in many forms
3. Smelling/ Gandhara	Swan	conch	Dutiful, intelligent	Throat	Defects Six
4. Medium	Sheep	cymbal	happy	middle of tongue	
5. Fifth	Cuckoo	Godhika	king and leader	nose	
6. Sixth/ Dhaivata	crane	Tymbal	Low qualities	teeth & lips	
7. Aboriginal	Elephant	Large drum	sinners	head	

The development of acoustics has led to the progress of civilisation of 20th century. The transformation and retransformation of sound in various forms of energies has led us to loudspeakers, radios, telephones and the like. These recent phenomena do not find mention in canons. One is also unable to trace the property of sound-proofness which has come to be a modern necessity. There is mention of conducting mediums in canons. Little mention of absorbing or non-conducting mediums is there.

Conclusion

The above descriptions indicate the canonical contents about many aspects of sound are supported by many observational and logical base. They contain sufficient factual truth but there seems to be sufficient gap in the way of explaining them. It is seen that scientists have added many newer aspects about sound over the canons. Their explanations also seem to be more realistic and intelligible in many cases. These contents represent in most part the Newtonian concepts though deve-

loped much earlier. However, the Jainas excel in details about sound over the Vaiśeṣikas. It seems that despite surfacial similarities about the canons and scientific postulates, the difference that exists qualitatively and quantitatively is much more to cast a keener eye on them. The canonical contents represent the stage of knowledge of their times and this comparative survey leads us to learn about the growth and gap existing between now and then. To assert the authenticity of canons, it is necessary to dive deeper with analytical mind to reduce the gap.

[B] Electricity and Magnetism

1. Electricity or Vidyuta

There is comparatively little description about electricity and magnetism in canons in comparison to heat, light and sound. The canons have used the term *'Vidyuta'* as proper noun and common noun[41]. As a proper noun, there are *Vidyuts* as queens, *Vidyuts* as celestials, *Vidyuts* as islands, *Vidyutamukha* as men and the like. However, it is the common noun which is pertinent to us. The term is actually indicative of electric lightning in the sky.

The first book *Ācārāṅga* does neither have this term, nor the fire-bodied ones have been classified there. *Daśavaikālika* also does not have this term despite classification. The *Cūrṇi*-authors have included it in the term *Ulkā* which is generally meteoritic fire known as sky-fire also[42]. It seems that on further observations, *Ulkā* (sky fire) varieties were specified. *Sthānāṅga*[43] mentions its four types :

(i) *Vidyuta* or electric lightning
(ii) Meteoritic falls (*Ulkā*)
(iii) *Dik-daha* (spatial conflagrations)
(iv) *Yakṣadīpta* (demonic lightnings).

It is stated that the monks should not study when any of these forms and other six causes are there. *Prajñāpanā* has only the first three of the above forms. Per chance, this and

Uttarādhyayana are the first secondary canons which define *Vidyuta* or electricity (and all other forms) as a variety of gross fire bodied substances[44]. Pūjyapāda (5th century A. D.) tells us that electricity is an example of natural bond independent of human effort[45]. It is produced by oppositely charged atoms (when they come in contact through any medium). The animistic theory of fire-bodied substances leads *Vidyuta* to be living which is in contrast to Vaiśeṣika school mentioning it as non-living and atomic[46]. However, mention of living and non-living nature of fire-bodied ones in *Sthāṇāṅga* makes a good point helping us to study the nature.

Post-*Prajñāpanā* scholars have generally followed the tradition of assuming *Vidyuta* as one-sensed fire-bodied substance. *Ulkā, ulkāpāta* and *taḍita* (special sound occurring when lightning takes place in sky) are other equivalent terms for *Vidyuta* though differing somewhat in their meanings. Actually, none of these things.are electricity but they either produce it or are its effects as the scientists call today. It is just formalisation of effect into cause.

Canons would call electricity as atomic or corpuscular in nature as other energies. It is produced due to the meeting positive and negative (*snigdhatva* and *rūkṣatva*) charges. It means that when two qualities of opposite natures meet, there is production of energy. When the energy is high and intense, it is known as electricity. In the various commentaries of *Tattvārtha-sūtra,* the terms, *snigdha* and *rukṣa* have been described as oiliness and roughness of the substance. The oilness has been exemplified by water, milks of goat, cow, buffalo, camel in or of increasing quality. The roughness has been similarly exemplified by dirt and sand. However, it is Pūjyapāda, who clearly mentions that *Vidyuta* is produced due to the attributes of oppositely charges. The important point here is the basic principle of contact of oppositely natured particles to produce electricity. This is indicative of ingenuity of Jaina scholars of early days. The Nyāya school does not

mention this point. It is said to be eternal (*ayonija*) form of *taijasa,* by them.

Dhavalā mentions an another term seemingly to be quite important. This is *vidyuta-karaṇa*[47]. It may have two meanings : (i) materials may be electrified and (ii) breaking away into the components of the composite – an indirect statement about electrolysis of today. This term belongs to 8th century A. D. which again reflects Jaina scholars deeper insight into the properties of natural forces. The book, however, does not exemplify the term.

The canons also indicate that the property of positivity or otherwise is characteristics of different atoms due to which they combine or produce electricity. Currently, electricity is taken as a flow of electric current for which a contact between two oppositely charged particles is necessary through a medium like wire. Every substance has its own electric nature which may be one of the two types – positive or negative and that is what it should be meant by the terms *snigdha* and *rūkṣa.* There has not been any method of measuring these qualities in olden days. The touch was the only means to judge the qualities crudely. But even this qualitative picture is important as these qualities are indicated by numbers and this numerical strength has been said to be solely responsible for the binding capacity of different atoms or substances. This point has been detailed in an early chapter. On the whole, the Jaina canonical postulates about electricity are tabulated in the following Table 6 with current views.

The physicists do agree about the variety and energetic *nature of electricity.*[48] *But they describe it wavicular rather than* particulate as postulated in other cases of energies. Moreover, electricity is not now produced naturally in sky only, it can also be produced by men from different sources like coal, water, wind and atoms. The natural energy has never been of any use to mankind except indirectly for his farming, the electricity produced by man has been useful to him in many ways to

improve his comforts in life. Thanks to Volta, Galvani, Faraday and others of the nineteenth century who laid the foundations of the age of electricity. The magnetic, chemical and heating effects of electricity have brought the man in the age of new civilisation of radio, television, loudspeaker, home appliances, telephones, tele-communications and many other facilities. One feels that there is more unification of humanity now than the religions proclaim. There is no mention of this man-produced electricity and its effects in canons.

Table 6 : Jaina Postulates about Electricity.

Jaina Postulates	Current Science
1. Electricity is a fire-bodied mattergy.	Agreeable.
2. It is atomic in nature.	It is flow of high speed electrons which are sub-atomic particles.
3. Lightnings etc. are forms of electricity.	These are effects of electricity.
4. Electricity is produced due to contact of opposite natured substances.	It is produced by contact of oppositely charged materials through wire.
5. Substances combine due to their electrical nature.	Agreeable.
6. Electricity production is a natural phenomenon.	Besided natural, it can also be produced by man from coal, water and atomic fission/fusion etc.
7. Interconversion of energies is possible.	Agreeable but in both direction.
8. –	It could be measured in different units.
9. –	It has many uses.

The physicists would not agree to the living nature of energies purely on account of their hotness as there are no

specific qualities there as ascribed to the living beings. Many people assuming it to be living do not use light bulbs and loud speakers. This seems to be a paradox. On the one hand, they would make the natural water non-living by heating and prescribe the heated and later cooled water for the saints and on the other hand, they would not use electricity becuse it is hot ?

The canons indicate the transformation of fire into light and electricity. Light can also be transformed into heat. This is clear from the heat produced from glasses or gems. There is, however, no example of transformation of electricity into heat in canons. It may be, probably, due to oversight about the conducting or insulating nature of substances. We are quite familiar with large number of useful applications of this fact in daily life.

The electricity could now be measured in terms of power in watts or kilowatts, voltage in terms of volts and current in terms of amperes. This quantitative aspect of electricity is also missing in canons. Table 6 has given many points of extension or modification of knowledge about electricity in current age over the canonical period confirming sufficient growth in post-canonical centuries.

2. Magnetism

Though canons do not contain the term magnetism, but history of magnets starts since 800 B. C. It has been defined with a power of attraction between two substances without contact. This power is maximum in iron. That is why, a magnet is called *'Ayas-kānta'*, iron-loving. It is said that the magnet attracts the iron without touching it. But if the iron (or the magnet) is covered, it will not be able to attract it. Thus, the attraction of iron by magnet without touching or covering shows its nature to be non-contactile as has been pointed out in case of vision by the eye. Hemcandra and Prabhācandra[49] have pointed out this property in their treatises. The Jaina literature does not have any other property besides this. The scien-

tists today proclaim magnetism as a form of energy like light etc. which is found in certain materials due to their specific molecular orientation. This energy is specially centered at the south and north boundaries in the forms of lines of force which has capacity to act in definite area. If the iron is within this area, it will be attracted. If it is beyond this area or the magnet is covered by impervious substance, it will not be attracted. Hence the magnetic attraction is caused due to the presence of invisible lines of force. Oersted and Faraday evolved the basic principles about them in nineteenth century.

The canons describe only the natural magnets like *Ayas-kānta.* This also does not include the biggest natural magnet – the earth. Magnetism has now been observed in substances other than iron. Many materials can be magnetised by rubbing them with the magnet or passing electric current through them. This artificial magnetisation is responsible for many electric machines and proves transformation of magnetic energy into electricity. Quantitative aspects of magnetism have also been developed.

Thus, we see that the observation of non-contactile nature of magnet seems to be a macroscopic one as the lines of force are invisible. The *Ayas-kānta* also becomes working under the indirect contact through the lines of forces like the eyes. The canons do not mention any other magnetic substance or magnetisation process which the twentieth century is familiar with. This all is suggestive of the fact that canonical contents about magnetism are comparatively the least.

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Section Four

Biology

Modern Biology deals with the two most important class of living beings — the plant kingdom, the least developed one and the animal kingdom with gradually developing consciousness. It has developed during the few centuries. However, the biological contents in Jaina canons are quite old. They have also primarily classified them in two classes, later sub-classifying in many types on physical and spiritual bases. This chapter presents a comparative study of Biology in the context of Jaina Canons and Modern Biology.

This section contains four chapters :

(i) Defintion of Living

(ii) Classification and Life-cycles of the Living

(iii) Plant Kingdom and

(iv) Animal Kingdom.

This section covers the canonical as well as current postulates and descriptions. It also deals with the staticism and dynamism in growth fronts of knowledge in these fields.

Chapter 12

Definition of Living

The three-level universe of the Jainas (lower, middle and upper) is the play-ground of all the entities found in it. It is its middle portion termed as middle, circularly flat or *tiryaka* universe which is important to us. The humans and animals reside in it. It is innumerable island-oceaned. The animals are collectively called as *'Tiryañcas'* or transverse movers. They are said to be crooked, instinctive and load-carriers having 1-5 senses[1]. They include plant and animal kingdoms. In contrast, human beings are 5-sensed and have highly conscious, active mental faculty. The following sections will deal with them. However, before we deal with them, it is pertinent to learn about their characteristics.

There has always been a visualisation about the existence of two distinct types of mutually supporting entities in the world with different characteristics. They are designated as non-living and living. However, both of these entities have faced difficulties in their proper origin and definition. First, there has been an unitary concept regarding their origin based on common-sense approach. Accordingly, one entity seems to be the specific form of the other. This approach has taken two faces — animistic and inanimistic. *Ācārāṅga* starts with animistic approach[2]. Everything in the world is living primarily, changed into non-living only by weapon-operation on it as pointed out in *Daśavaikālika*[3]. Thus, the non-livingness originates form the living ones due to their operation or death. This view coincides with the terminal Upaniṣadic and Vedāntic thoughts.

The inanimistic approach is reverse. It holds that livingness arises through specific inanimistic combinations. It is a

specific state of the non-living. Thus, there is no separate living for materialists like Cārvākas or Buddhas (who call it as aggregation of five *skandhas* or basic elements and equivalent to the physical body and psychical mind). They seem to believe in spontaneous generation of life. The continuity or feeling of similarity is said to be due to continuing streams of sub-conscious mind impressions (*Vāsanā*) like a burning lamp[4]. This postulate is also partially supported by *Ācārāṅga* which classifies mobile beings in eight varieties on the basis of birth including spontaneous generation[5]. It seems there was a time when both options were acceptable.

It is difficult to guess when independent existence of these two entities was formulated. Probably, the *Ājīvikas* were the first to make an advance over the above unitary spiritualist or materialist views by assuming the living as separate entity from the non-living one. Their living unit is material in nature. It has transmigration properties – a non-aryan theme according to Basham[6]. It is atomic, circular or octagonal in shape and blue in colour. Basham has called some of these points as strange, fantastic and bizarre. Since then, whatever may be the origin of the living, it has been treated as a separate entity by most Indian philosophers denoting it by several names as tabulated in Table 1. Each of these systems has its own description about it having many similar or dis-similar points regarding name, nature and properties. The non-material living cannot be identified without its association with fine physical bodies with different names : *Liṅga-śarīra* (S), *Sūkṣma-śarīra* (V) or *Taijasa or Karman śarīra* (J). That is why the living one in the world is said to be impure with self-purification as its aim of worldly life. How this non-material and pure living becomes initially impure, is not very clear even from Jaina canons for a common man[7]. Though some philosophies have different names for worldly living (*Jīva, Jīvātmā*) and pure living (*Ātmā, Paramātmā* etc.), but the Jainas have intermixed the two states of the living during their descriptions creating some

confusion among scholars and votaries. The current description will presume the worldly or impure living as *Jīva* and pure living one as *Ātmā* or soul.

Table 1 : Denotations of Living Entity in some Indian Systems.

System	Name	Nature	Definition
1. Cārvāka	*Jīva*	Material, Non-pemanent	Spontaneous Consciousness
2. Upaniṣad	*Jīva, Ātmā Parmatma, Brahma*	Non-material, permanent	Knowledge, energy
3. Sāṅkhya	*Puruṣa*	Non-material, permanent	Consciousness, Unchangeable
4. Vedāntins (V)	*Jīva, Ātmā*	Non-material, permanent	Consciousness
5. Nyāya-Vaiśeṣika (NV)	*Atmā, Jivātmā*	Non-material, permanent	Adventitious Consciousness, Happiness etc.
6. Jainas (J)	*Jīva, Ātmā*	Material, non-material, Permanent-cum-non-permanent	Consciousness
7. Buddhas (B)	*Pudgala*	Material, non-permanent	Mind activity

Ācārya Umasvātī is an isolated aphorist who does not use the term *'Atmā'* in his *Tattvārtha-sūtra* and *Praśamarati Prakaraṇa*. He has written them for the upliftment of poor *Jīva* to free himself from worldly or *kārmic* clutches. In the canons also, we have the term *Jīva* though *'Appā, Āyā, Ādā, Attā'* and other terms (meant for pure living) are seen in countable places. Kundakunda[8] has defined the two terms interchangeably in terms of pragmatic (worldly impure) and idealistic (karmically freed) aspects. He might have taken clue from adopting NV and V systems who pointed out the realistic and synthetic approach for extremist ideas about the living. It

is, however, very difficult philosophically to prove and scientifically to disprove the pure living.

The Jainas are non-materialists about the pure living and materialistic about the worldly living. They also favour the postulate of separate existence of the living entity since the *Ācārāṅga* period. The Jaina logicians prove the existence of the living on the ground of : (i) doubt about it, (ii) the realisation of 'I', (iii) substratum of consciousness and (iv) its manifold functions[9]. The function of mutual support is also the proof for worldly living. A number of phenomena or feelings (like happiness, life-span, death, respiration, embodiment, inkling of eyes, mind, etc.) given as proof for the living by NV philosophers[10] are said to be material in origin by the Jainas[11]. The many facet description of the living abound in large number of Prākṛta canons and their later commentaries. Though the canonical object is moulded more towards spiritual aspects, yet references to its physical and biological aspects are not wanting. The scholars like Lodha[12], Jain[13], Sikdar[14] and Pralayankara[15] have attempted towards this direction. It will, however, be endeavoured here to sum up and evaluate the overall Jaina picture in this regard.

The worldly living or *'Jīva'* is material and impure because of its inherent adherence to fine and gross luminous and kārmic body or other particles. It could be described in better positive terms and subjected to physical descriptions and scientific verification or evaluation. One could easily extrapolate from impure to pure state of the living. It is surprising that large number of modern concepts regarding the living were developed by the Jainas even before the early Christian era. Some of the points of contrast are now coming to the point of comparability.

Attributive Definition of Living Entity

The living, a separate reality has two types of definition : general and specific. The early canons like *Ācārāṅga*[16], *Daśavaikālika, Bhagavatī,* Kundakunda's *Pañcāstikāya* and *Dhavalā*

of Vīrasena described its characteristics as given in Table 2. Though not referring them as general or specific, yet containing many general and a number of specific properties. *Ācārāṅga* describes the property of sensitivity, irritability or consciousness (in terms of feeling for pain when weapon-operated), killer weapons and method of attaining soul-hood by the *Jīva* in the first instant. This concept gets modified there itself with reference to plants indicating some nine points mostly proving the material nature of *Jīva*. These points grew to a maximum of 23 in *Bhagavatī* (increasing from six marked with asterisk in Table 2)[17] with 17-20 in *Pañcāstikāya*[18] and *Dhavalā*[19]. The terms *'Ātmā'* and *'Antarātmā'* connote different meanings in these characteristics from their general meaning. When this change of meanings did occur-is a matter for scholars to dive deeper.

Some duplication is visible because of similar meanings of a few terms. However, only three terms represented as the non-observable, most of them represent observable properties when *karma* particles are taken as material. The facts have been dealt in detail in *Pañcāstikāya, Dhavalā* commentary and *Nava-padārtha* of Bhikhanaji[20]. Moreover, *Bhagavatī, Taṇḍula-veyālīya* and some other canons also mention the size, weight, reproduction and adaptability characteristics of the living[21].

Contrastingly, Kundakunda and *Dhavalā* give 17-20 attributive terms, many of them have similar meanings as in *Bhagavatī* with minor differences. Quite a good number of terms assume non-materiality, weightlessness, thought activities, physical body, size and the like to the living hitherto not mentioned by the canons like *Ācārāṅga* and *Bhagavatī*. Its reason may be that the early canons assumed it a nearly material in contrast to Kundakunda's presumption of basically non-material nature of living. That is why he has not mentioned birth and growth of the living while in *Dhavalā* these terms are *mentioned.*[22]

One could currently equate sensitivity or irritability with

Table 2 : Attributive Names of the Living Reality.

Ācārāṅga	*Bhagavati*	*Kundakunda*	*Dhavalā*
1	2	3	4
	1. It has *Prāṇas*/vitalities (*Prāṇī*)*	1. It has physical/psychical *prāṇas* (*Prāṇī*)	1. *Prāṇī*
	2. It is knower/experiencer (*Vijña*)*	2. It has knowledge/conation (*Upayoga*)	2. *Mānava* (*Kṣetrajña*)
	3. It has capacity to bind karmic particles (*Sattva*)*	3. It is associated with kārmic particles (*karmayukta*)	3. *Kartā*
	4. It is actor/detractor of karmic particles (*Kartā/ vikartā*).	4. It is actor of kārmic particles (*kartā*)	4. *Kartā*
	5. It is collector, victor, leader of karma particles (*cetā, jetā, nāyaka*)	5. It is enjoyer of karma particles (*bhoktā*)	5. *Bhoktā*
	6. It is material and has body (*pudgala, sa-śarīrī*)	6. It has extension upto innumerable space points (*Asaṅkhyāta pradeśī*)	6. *Pudgala*
	7. It is pervasive in the body (*Antarātma*)	7. It is pervasive in the body (*Aikya*)	7. Viṣṇu (Pervasive)

1	2	3	4
	8. It moves (*Jagat, Hinduka, Ātmā*)	8. It moves in all directions (*Upakrama*)	
	9. It has life-span (*Jīva*)*	9. It has life-span (*Jīva*)	9. *Jiva*
	10. It gives aura of love/ hate (*raṅgana*)	10. It gives aura in the body (*Prabhāsana, raṅgana*)	
		11. It has extension of body-size (*dehamātra*)	
		12. It is imperceptible to senses (*Amūrta*)	
		13. It is weightless (*aguru-laghu*)	
		14. It has potency to live in different states (*Prabhu*)	
1. It can be transformed in different states (*Vipariṇāmī*)	—	—	
2. It takes/gives birth (*Jāti*)	11. It takes birth (*Jantu*)	—	10. *Jantu*
	12. It gives birth (*Yoni*)	—	11. Speech

1	2	3	4
3. It grows (*Vṛddhi*)	13. It has particulate nature	—	12. Attachment
4. It takes food (*Āhāra*)	—	—	13. Expansion
5. It fades or gets sad (*Mlāna*)	—	—	14. Contraction
6. It is mortal (*Anitya*)	—	—	15. Activity (*Yogī*)
7. It is imperamanent (*Aśāśvat*)	—	—	16. It lives inside kārmic body.
8. It has a metabolism (*cayopacaya*)	—	—	17. It has pride
			18. It has deceit
Non-observables			
10. It has consciousness (*Cetana*)	14. It has sensitivity towards good/bad (*Veda*)*	15. It has element of consciousness (*cetā, cetanā*)	19. *Veda*
	15. It has neither beginning nor end (*Bhūta, Mānava*)*	16. It has neither beginning nor end (*anādi-nidhāna*)	
	16. It is self-existent (*Svayambhūta*)	—	20. *Svayambhū*
		17. It has five volitional activities (*Bhāva*)	

consciousness in these cases. The two terms of *'Vijña'* and *'Veda'* in *Bhagavatī* convey sense of consciousness. The same is true for Kundakunda's two terms – *upayoga* and *Cetana* having similar meanings. One, however, finds a difference in the meaning of the terms *'Cetā'* and *'Cetanā'* in *Bhagavatī* which mean collector of *karma* particles rather than consciousness. Assuming *Bhagavatī* as the older canon, one may infer consciousness was evidently not a basic property of the living in early philosophical development. Does this mean that the Jainas had similar views with NV theory in the beginning in this regard ? When was this concept of concommittant consciousness evolved in Jaina philosophy ? This needs a further academic scrutiny. The use of two terms – *Upayoga* and *Cetanā* – characterising the living seems to bear some impression in this regard. By mentioning 'speech' also among the attributes of living, *Dhavalā* has slightly differed in this regard. Because speech is specific for human beings rather than general living beings.

Ācārya Umāsvāti[23] and Kundakunda — both stated two types of characteristics. The former mentioned five types of volitional or thought activities (the last one including all general attributes in current terms) and *Upayoga.* Pūjyapāda[24] defined *'Jīvatva'* as consciousness. To him, all living beings have inherently a life element or consciousness. It may have two aspects – capacitative and functional. It is subjected to various types of volitional activities due to realisation, subsidence and destruction of fine *kārmic* particles and inherence. The activities also prove material nature of the living as they are related with mind-endowed consciousness. These activities include 53 types of actvity of physical and psychical nature. The canons describe six types of such volitional activities[25]. Their details are summarised by Umāsvāti as shown in Table 3. Many activities are common in a number of volitional activities representing their different degree and status. These are various expressions of element of consciousness through its

Table 3 : Different Volitional/Thought Activities of the Living.

	Subsidential 2	Destructional 9	Mixed 18	Realisational 21	Inherent 3+10
1.	Right belief	Right belief	Right Belief	1-4. Destinities	1. Livingness
2.	Right conduct	Right conduct	Right conduct	5-8. Passions	2. Salvation capacity
3.	–	Knowledge	3-6. Knowledge-4	9-11. Sexes	3. Non-salvation capacity
4.	–	Conation	7-9. Wrong Knowledge-3	12. Wrong belief	4. 10 others
5.	–	Gift	10-14. Attainments-5	13. Wrong Knowledge	–
6.	–	Gain	15-17. Conations-3	14. Non-restraint	–
7.	–	Enjoyment	18. Restraint-non-restraint	15. Non-salvation	–
8.	–	Re-enjoyment	–	16-21. Colourations	–
9.	–	Energy	–	–	

capacity of knowledge and conation. The living one has the capacity of experience and susceptibility towards sensation of various types. These capacities vary from a negligible extent to infinity depending on the types and development of livingness. The volitional activities are differentiating attributes supported by Akalaṅka[26]. These activities are related to mind or brain in current terms. Psychologists have delved deep into the nature and function of mind. Some have equated it with consciousness itself and called it as substantive. This substance may be materially protoplasmic or non-materially psychoplasmic as suggested by Bausfield[27]. The true definition of these two terms depends on the meaning of what we call material. In pre-microscopic age, the terms conveyed the idea of sense-imperceptibility, thus indicating its non-material nature. It has, however, become material in microscopic age.

Bhagavatī and *Dhavalā* do not mention these volitional activities in this connection. Devasena also does not mention them. Instead, he mentions six special attributes of the living; consciousness, knowledge, conation, bliss, energy and non-materiality (with duplication of two – the first and last general attributes)[28]. He has also used different terms in this regard. Thus, despite consciousness being a common namal characteristics for the living, the terms used by canonists and procanonists seem to create some difficulty for general votary for proper understanding.

Characteristics of the Living

The Jainas have characterised the living in many ways. They have some physical aspects attached to it. They also have some mental states associated with it. The physical aspects include – (a) Vitalities or *Prāṇas* (b) Completions or *Paryāptis* and (c) Instincts or *Sañjñās*. The mental aspect involves volitional activities, the manifesting symptoms of consciousness or *Upayoga*.

(a) Upayoga or Functional Consciousness

Uttarādhyayana[29], *Bhagavatī*[30] and *Sthānāṅga*[31] mention

functional consciousness as one of the innate property of the living, followed by Kundakunda, Umāsvāti and others. But the definition of *Upayoga* has varied with times for long. *Sthānāṅga* suggests that the term means determinate and indeterminate knowledge alone as conational manifestations have been mentioned there separately[32]. However, Umāsvāti[33], like *Bhagavatī*[34], means both knowledge and conation by this term, though Kundakunda uses two different terms – *Upayoga* and *Cetanā* in many of his compositions to mean *'Upayoga'* alone[35]. Akalaṅka clearly gives different meanings to these two terms. He opines that *Upayoga* is the manifestational form of consciousness and is a capacity factor. Does the above dual terminology of Kundakunda have some bearing on the order of his compositions ?

The literature reveals some difference regarding the meaning of the term consciousness itself (*Cetanā*). While to Umāsvāti, it means only knowledge and conation. Devaṣena keeps separate from it in his six specific qualities of the living (10th century). *Bhagavatī* and *Akalaṅka* add bliss and strength also to the meaning of consciousness as it is a general property of the living comprehending a group of qualities like bliss, strength, knowledge and conation. All these qualities, therefore, characterise consciousness. The term, thus, represents, the generality of attributes distinguishing the living from the non-living. Mehta[36] also opines similarly. This seemingly correct interpretation suggests that its meaning has been modified in terms of four infinities in comparison to early periods. However, the general votary, conventionally takes it in terms of knowledge and conation only. Rājamalla[37] has added another dimension to the term by pointing out its knowledgal and actional varieties. This requires elaboration.

(b) Vitalities, Vital Airs or Prāṇas

Ācārāṅga mentions four terms – *Prāṇī, Bhūta, Jīva* and *Satva* to denote the living in general[38] without defining them. *Bhagavatī* gives their etymological meaning as representing the living. However, commentator Śīlāṅka[39] has indicated that each

term represents different classes of living as shown in Table 4. *Bhagavatī* definitions seem accurate. The important fact here is that all these terms represent observable qualities of physical expressions of the living.

Table 4 : Meaning of Terms Denoting the Living.

Terms	Etymological Meaning[17b]	Śīlāṅka commentary meaning
1. *Prāṇī*	Vital aired, having vitalities	2-4 sensed living beings (Mobiles)
2. *Bhūta*	Tri-timal existence	1-sensed beings (plants or immobiles)
3. *Jīva*	Durational existence	5-sensed beings
4. *Sattva*	Good/bad *karma* binding existence	Rest of the types of living beings

The definition of the living has been concocted here in the first term also with the first term of Table 2. It has been called *Prāṇī* as it is characterised by *'Prāṇas'* translated as life principle, life force, life winds, vital airs and vitalities. The existence of vitalities is the most important property of the living. That is why *Dhavalā* refers vitalities as the cause or instruments of livingness[40].

Canonically, there are four vitalities of (i) strength, (ii) senses, (iii) respirations and (iv) duration or life-span or age sub-classified into ten types : (i-iii) three strengths of physique, speech and mind, (iv-viii) five senses known popularly and (ix-x) the last two as individual units[41]. This is in contrast with 4-7 vitalities by Vedāntins. It is said that the lowest class of living ones has at least four vitalities out of ten : (i) sense of touch, (ii) strength of physique, (iii) respirations and (iv) age. This number increases upto ten as the living character is gradually developed as shown in Table 5. Later scriptures classify the vitalities in terms of physical and psychical varieties. The physical varieties are material in nature while qualities like three jewels or consciousness itself is a psychical vitality[42].

Table 5 : Vitalities among Living Beings.

No.	Type of living beings	No. of Vitalities	Names	No. of Completions
1.	1-sensed beings	4	Sensed of touch, *Strength of physique*, respiration, age.	4
2.	2-sensed beings	6	First 2 senses, physical & vocal strength, respiration, age	5
3.	3-sensed beings	7	First 3 senses, 2 strengths, respiration, age	5
4.	4-sensed beings	8	4 senses, 2 strengths, respiration, age	5
5.	5-sensed, without mind	9	5 senses, 2 strengths, respiration, age	5
6.	5-sensed with mind	10	5 senses, 3 strengths, respiration, age	6
7.	5-sensed non-completioned	7	5 senses, physique, strength, age	6
8.	4-sensed non-completioned	6	4 senses, physique, strength, age	5
9.	3-sensed non-completioned	5	3 senses, physique, strength, age	5
10.	2-sensed non-completioned	4	2 senses, physique, strength, age	5
11.	1-sensed non-completioned	3	1 sense, physique, strength, age	4
12.	Beings of 13th spiritual stage	4	Physique & Vocal strength, Respiration, age	–
13.	Beings of 14th spititual stage	1-3	(i) Age only. (ii) Respiration and age. (iii) Respiration, age, physique strength.	–

Sāṅkhyas[43], *Vaiśeṣikas*[44], *Vedāntins*[45] and *Āyurveda* scholars[46] have also the word *'Prāṇas'* with reference to the living. They have comparatively quite a restricted meaning of the term. Activities like vibration, expansion, contraction is the vedic view[47]. The inhaling and exhaling are their main idea during which one takes in air and gives it out in and through different parts of the body. This process of respiration supplies the necessary energy for physiological processes occuring in the body at every moment. This energy is known as Fire of Fire-god. Hence *'Prāṇa'* is the fire. Vedāntins will equate them with senses as well as airs[48]. *Sāṅkhyas* clearly state that *'Prāṇas'* etc. are five airs. *Vaiśeṣikas* also mean respiratory activity by this term but they agree to five airs. In contrast, the Jainas have a more complex concept about these vitalities.

Ācārāṅga means the living unit by itself[49] and *Bhagavatī*[50] means respiration by this term. The commentator Śīlāṅka and Agastya Singh[51] mean mobile beings with observable respirations. Does all this indicate that livingness in 1-sensed plants is a post-canonical phenomena ? Umāsvāti also has referred *'Prāṇas'* at many places as material. He was supported by Pūjyapāda[52] and Akalaṅka[53]. This term also means respiration for him.

All this suggests that the term *'Prāṇa'* was used in the same sense by Jainas as in other philosophies. Later, more activities of the living were observed to cover physical, vocal and mental ones. They incorporated the senses, their sensitivity, and physico-chemical actions together with the duration of these activities. Thus, its meaning was also extended to comprehend all the terms in general which gave a better meaning for the term for the Jainas. Even, Kundakunda[54] has this meaning in mind and now it can be seen that respiratory process becomes only a part and not the whole of the term *'Prāṇa'*. When and how this widened meaning was coined by the Jainas, is a subject-matter for scholar's pursuit.

During the days of spiritualistic trend in philosophy and

symbolism replacing factualism[55], the term *'Prāṇa'* also seems to have been spiritualised to mean a force or energy making it indefinable in physical terms. It became spiritual air or even *Brahma* for Vedāntins[56]. That is why it has been translated through many terms in English. The Yogis have also a term called *'Prāṇic* energy'. At times, the common air or oxygen was called *'Prāṇavāyu'*. For simplicity, we have to be better factual. Thus, we have the term vitality or vital airs representing the most appropriate meaning for various *types of fluids or gases* so necessary for different types of physico-chemical activities including the respiratory one which is the most essential or direct proof of livingness. The Samskṛta-Hindī dictionary also supports this meaning[57]. However, the term should not only mean the respiratory activity but any process essential to life and supplying the necessary energy for functioning, maintain-ance and growth of various organs of the body. Thus, vitality, rather than the vital airs should be the preferred term in English for *'Prāṇas'*. Normally, the processes occurring in body for defining the livingness have been mostly found to be exother-mic chemical reactions. More recently, Gurudatta's commen-tary on *Nyāya-sūtra*[58] maintains that air and *'prāṇas'* are synonymous and mean inner energy rather than physical material. The livingness is the functional aspect of *'prāṇic'* energy. This statement requires revaluation. *Aṣṭāṅga-saṅgraha* mentions *'prāṇa'* to mean blood which has never been a generally acceptable view.

Because of the difference in meaning of *Prāṇas* in various systems, one finds different numbers of vitalities in various systems as shown in Table 6. This does not require further discussion.

As the Jainas have wider meaning of the term *'Prāṇa'* and there seems to be duplication of the terms of senses, respirations etc., the pro-canons have clarified between the senses and sense vitalities. The sense vitalities are due to destruction-cum-subsidence of conation-obscuring *karma* while

the senses make a different class of *karma*-physique making *karma*. Thus, the *kārmic* origin of the two is different[60]. There is also a question on the three (respiration, vocal and mental strength) regarding their being called vitality as they do not seem to be life long. The non-completioned beings do live even without them. However, it is with respect to the completioned beings that these are included in the vitalities. Nevertheless, it is surprising that respiratory activity – an essential characteristics of livingness, seems to be denied to the non-completioned beings. How could an entity be called living without even dormant respiration such as in plant kingdom ? The state of non-attainment of body completion is non-respiratory. The other type of non-completion is called formative and it could be included in the completioned class only formally because it has a chance of full completion.

Table 6 : Different Numbers of *Prāṇas* (vitalities) in Various Indian systems.

No.	System	No. of Vitalities	Name
1.	*Vedāntins*	7-11	2 eyes, 2 ears, 2 nasals speech, arms, navel, pelvis, mind
2.	*Nyāya*	5-7	5 senses, speech, mind
3.	*Sāṅkhyas*	5	*Prāṇa, Vyāna, Udāna, Samāna, Apāna*
4.	*Jainas*	10	5 senses, 3 strengths, respiration, age
5.	*Āyurveda*	12	–
6.	*Saṅgīta Ratnākara*	10	5 vital airs + 5 others
7.	*Śabda Kalpa-druma*	10 or 16 (49)[59]	

(c) Completions or Paryāptis

The occurrence of completions is also a characteristic

for the livingness. Every living being develops the above vitalities depending on its sensory development until all of them are fully functional. The living is, then, called completioned. In case of many living beings, this may not be so and they die before completions. Such beings are called non-completioned with respect to body or senses. However, the canons indicate that it takes about 48 minutes for this completion process[61]. The quantum of livingness is also guessed by this completion process.

This gradual development has six stages. Firstly, the living or embryo (i) takes food for building and running life. Food causes (ii) body to develop which results in development of (iii) physical and conceptual senses depending on the class of livingness. When senses develop, (iv) respiration (v) speech and (vi) mind or brain also appear. Those living beings with mind are called fully completioned. It is assumed that all these stages start nucleating simultaneously but they develop in a sequence in about 48 minutes. These six stages are collectively known as completions or *paryāptis*. *Dhavalā*[62] mentions that these are the causes of different vitalities. It defines them as the formation or perfection of different organs or energetic mattergic aggregates of the body which has been modified as the cause of such formations. Pūjyapāda and Akalaṅka also give similar definition to that of *Dhavalā*. But later on, many authors presumed it to be an acquirement of energy for these formations. This seems to be a cause-effect formalisation.

There are six completions covering each of the above stages – (i) food, (ii) body, (iii) senses, (iv) respiration, (v) speech, (vi) mind. It is seen that these six correspond to nine of the vitalities as shown in Table 7. The vitality of age may be said to be the resultant of these completions. Like the vitalities, the lowest living ones have four completions in appearance. Higher ones show all the six as shown in Table 5. Some canons[63] mention five completions by combining V and VI state.

However, most scholars have followed the six tradition.

Table 7 : Completions and Vitalities.

No.	Completions	Vitalities
1.	Food	–
2.	Body	1. Physical strength
3.	Senses	2. Sense of touch
		3. Sense of taste
		4. Sense of smell
		5. Sense of sight
		6. Sense of hearing
4.	Respiration	7. Respiration
5.	Speech	8. Vocal strength
6.	Mind	9. Mental strength
		10. Age
	Minimum occurrence 4	Minimum occurrence 4

The concept of vitalities is found in early literature in almost all Indian philosophies while the concept of completions is specific to the Jainas. It is found in *Bhagavatī, Jīvābhigama, Ṣaṭkhaṇḍāgama, Mūlācāra* and other later canons. Generally they are referred to as one of the disquisition doors for the living and taken as one of the physique-making *karma*. This, however, has a variety of respiration but no other vitalities. The following discussions will lead to the better understanding of completion and vitalities. Table 7 suggests duplication between vitalities and completions. However, they have been said to be as distinguished as two mountains[64]. Many vitalities are not found in non-completioned stage, they are effects of completions. Probably completions are not the basic characteristics of the living as the vitalities, the durational aspect is absent among the former. However, they could be indirect characteristics as there could be no livingness and vitalities without them. While differentiating between them, Akalaṅka[65] suggests completions to be supra-sensual and imperceptible by sense of touch and hearing in contrast to vitalities. This suggests the

later to be physical and functional in nature and not a form of mysterious force as suggested by Sikdar[66]. He has also called completions as vital force or actual living material consisting of many substances nearing protoplasmic type causing the capacity to develop various vitalities. If both these terms are treated as unique mysterious forces, it will be difficult to explain them in current terms. Moreover, two forces for the same purpose seem to be superfluous. Secondly, this opinion has no canonical support as vital force theory is not teneable for the Jainas. Sikdar also seems to be off the track when he equates completion with a force and a nearly protoplasmic material as these two entities have different natures.

The names of completions indicate their physical nature, representing formation of various organs to perform different functions – internal and external. For example, the respiratory completion should mean development of nasal organ, heart and nervous systems. Any system requires energy, normally supplied by food intake during its digestion and metabolic transformation for working. In absence of respiratory system, the above processes will become difficult. Even the development of various systems will not be possible. Thus, completions are a physical phemomena and not supra-sensual as pointed by Akalaṅka. Actually, the respiratory inhaling or exhaling is perceptible in all normal and special cases. One of the nostrils is warmer than the other during the process. In a sense, they seem to be grosser than vitalities. The physico-chemical or physiological processes occurring in various organs are known to generate energy to give strength and energy. Thus, completions are primary physical processes of developing body and its various organs and supplying the necessary caloric energy or force (inherent outcome of food intake) for different vitalities to grow and function. In other words they are primary growth of organs neceassary to develop characteristics of vitalities. This view conforms also the cause-effect relationship between the two. This view will support Sikdar's sugges-

tion of protoplasmic (enzymic or nucleic-acidic) nature of completions though this much fineness could not be assumed during the canonical and pro-canonical periods. These terms could only be understood correctly by taking the spiritual sheaths off from their definitions. One, then, finds that Jaina scholars were keen observers of physical and functional aspects of the living.

(d) Instincts or Sañjñās

According to the Jainas, every living being has some natural instincts, trends and desires which have been called *'Sañjñās'* being physical or psychical. It has various meanings – name, knowledge, desires, thinking capacity about good or bad or mind[67]. Kārmically, *Sañjñās* are due to prematuration and subsidence-cum-destruction of delusion and feeling producing *karmas* together with knowledge and conation obscuring *karmas* and also due to inherent consciousness or sensitivity of many types in the living beings. Hence, there may be variations in their number and varieties. It is said that consciousness may be expressible in terms of (i) knowledge and (ii) experience. The experiencial consciousness is found in all living beings while knowledgal one is found in the higher living ones. Thus, the *'Sañjnas'* here should be taken as natural or innate instincts found in all living beings.

The Digambara pro-canons[68] and *Jīvābhigama*[69] mention four such basic instincts of (i) food, (ii) fear or irritablity, (iii) sex and (iv) possessions or belongings. Some substitute sleep or rest for the last one. *Prajñāpanā*[70] mentions ten such instincts which include the four above and (v) anger, (vi) pride, (vii) deceit, (viii) greed, (ix) tradition and (x) whim. *Ācārāṅga* commentator Śīlāṅka points out sixteen instincts which include the ten above and (xi) pleasure, (xii) pain, (xiii) disgust, (xiv) sorrow, (xv) delusion and (xvi) religion. It is said that all these are experiential instincts. These include many psychical instincts from anger upto religion. These are not found in later literature. When one adds five cognitional

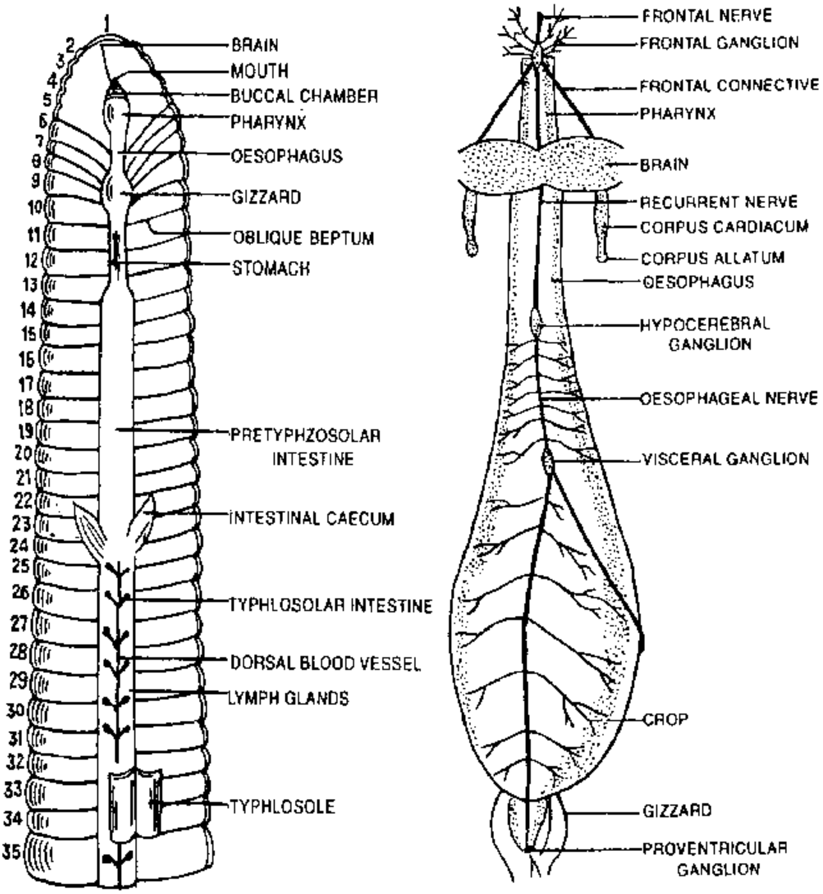
instincts according to *Niryukti*, the total instincts turn out to be twenty-one. Thus, there are sixteen experimecial and five cognitive instincts. However, if Mahāprajña opinion is taken, the tradition and whim instincts represent knowledge and conations and not the conventional meanings. This will reduce the number of instincts without loosing any essence about them. Scholars believe that these instincts belong to the living beings with brain or physical and psychical mind. They also postulate that only five-sensed beings possess mind and they are the only instinctive. Other beings upto four senses, therefore, do not possess these instincts. This is not correct today and even according to *Prajñāpanā*, all the ten instincts are found in all the living beings though dormant in the deficient-sensed beings. Commentator Ratnākara[72] has referred these instincts in a different way and classified them in three types – (i) longtimed and memorical (uterine born ones), (ii) logistic (2-4 sensed beings) and (iii) poly-viewing (right faithed ones). They seem to refer to the living beings with developed mind. His statement regarding possession of these instincts by different categories of beings requires critical examination. Moreover, with reference to traditional instincts, there seems to be some ambiguity in two cases – (a) libido and sex and (b) greed and belongings. *Dhavalā*[73] mentions a fine difference between them and cites support for their separate inclusion. Śīlāṅka cites five types of knowledgal instincts in terms of five knowledges.[74] *Gommaṭasāra* adds another discussion to the term. It points out education, action, instruction and receipt are the instincts which are the functions of mind. These may not be found in the deficient-sensed or mind-unendowed beings. This point also requires elaboration.

It should be noted that canonically, there seems to be no relation between the noun *'sañjñā'* and adjective *'Sañjñī'* as the first refers to the above instincts while the latter term refers to the living beings with mind only. Of course, mind is one of the meaning of *'sañjñī'* utilised here. That is why, we

have two disquisition doors of 'instincts' and 'minded or brained'. This suggests the living beings with instincts but without mind. A large number of dialogues contained in *Dhavalā* and *Rājavārttika*-2[75] suggest similar questions – a man would ask today – as were asked 1100 years ago. Pūjyapāda also clarifies this difference in meaning of these terms because of numerous meaningness of words pointing out flaws of theoretical over-extension in meanings other than 'mindedness'[76] for the term *'sañjnī'*. However, with current experimental verifications as pointed out by Lodha[77], the responses to the instinctiveness and mindedness of 1-sensed and deficient-sensed living beings in *Dhavalā* and *Pañcāstikāya* commentary become subject to better elaboration. *Pañcāstikāya* commentator mentions that the living beings other than 5-sensed ones have specific types of destruction-cum-subsidential mind rather than general[78]. Similarly, the quality of experiencing the sensitivity of colour etc. by deficient-sensed ones is different from that of the 5-sensed ones. In Jainism, mind has a separate existence and it is not found in 1-sensed and deficient-sensed ones as per naturally valid canons. The absence of mind in them is not contradicted by direct proof as it is imperceptible by senses. The existence of verbal knowledge in these living beings can also not prove the existence of mind as it could be found even in plants (which are devoid of mind) and it is not only sound-originated but non-verbal also. Thus, the later scholars do feel that non-5-sensed beings have the limited functions of mind-non-verbal knowledge and functioning towards beneficiary activities and aversion towards undesirables. Akalaṅka has given surprising answer to this problem. He maintains that these are the spiritualised senses in non-5-sensed living beings which are responsible for their activities associated with mental functions[79]. He feels such senses have capacities to experience pains and pleasures as found in these beings.

Lodha[80] has discussed how scientific experiments

prove existence of physical and psychical instincts (like anger, pride, aural colouration, etc.) in plants. Zoologists maintain that many living beings with deficient sensing (like rotifera, chiton, sepia, polycheta, leech, pheritima, cockroach (fig. 1, 2) have brain and head. This could explain many of their existing functions. Thus, the opinion of early scholars regarding the *questions of relationship between instincts and experien*ciable feelings as shown above may only be partially true. It is, however, acceptable that the mind of these beings is not so developed and so big in size as that of human beings.



(Figure 1, 2)

To find the equivalent term for the word 'mana' has always been a problem. It is equated generally with current mind. However, when the question of physical and psychical mind comes in the way, it is the brain which is equated with physical mind. The psychical mind is precursor energetic source of brain functions. This equation leads to existence of psychical mind among the non-5-sensed living beings. Could it be canonically correct ? The author feels it could be a better plea for this problem than assuming transformation or modification of soul into senses. How a non-material soul could do so is a deeper problem for answer.

The characteristics of instincts is merely an extension of the basic quality of sensitivity, irritability or consciousness showing its various modes of expressions. It should not be taken as any additional property of the living. The defining of the living through vitalities and completions, however, suggests the material approach for the living.

Classification of the Attributes

All the attributes of the living found in canons and described above may be termed as specific in current terms. It seems that the term *'dravya'* or reality was not a Jaina coin as Kundakunda and Umāsvāti have used *'Astikāya'* and *'Tattva'* terms for it. The *dravyas* become real because of their property of permanence through changes. Umāsvāti uses the term *'Dravya'* at quite a late stage in chapter 5 of his TS. It could be presumed that the term *'dravya'* of NV system was included in Jaina metaphysics at a later stage when this system was having a profound scholastic appeal in the world of seers. This has also been observed by Malvania specially in case of Umāsvāti[81].

Reality has been elaborated with similarities (general) and dis-similarities (specifics) by the Vaiśeṣikas. This has been followed by Umāsvāti. Accordingly, the general definition of reality detailed earlier applies to the living one as it has existentiality, *i. e.*, permanence through change (birth and

decay). It has qualities and modes. It has eleven attributes of *Akalaṅka and eight of Devasena (general). It also has eleven* general natures (*Svabhāvas*) of Devasena which refer to the ways and forms the living one may have in general. These various classificatory attributive definitions are shown in Table 8. It is seen that Akalaṅka and Devasena have improved over Umāsvāti where two attributes have gone upto four commons and many more uncommons. However, one could mark the difference. While Akalaṅka does not have consciousness, weightlessness and space occupancy of Devasena, the latter also does not have many attributes of the earlier. It can be surmised that the earlier characteristics of existentiality has been given more concrete meanings by these authors. As is clear, the general definition involves particulate nature, space occupancy, weightlessness, sense-imperceptibility or non-materiality as physical and consciousness as psychical characteristics of the living one. The first and last terms here seem to be quite contradictory. It is also evident that Akalaṅka's general definition seems to weigh more on the non-material side of the living in comparision to Devasena. If one removes the attribute of consciousness from Devasena's list, it will have purely material nature of the living.

In contrast, the specific attributes have very much in common with all the three authors – each one has various forms or expressions of consciousness as liberally defined earlier. The canonical characteristics of the living in Table 2 can also be similarly classified on the basis of table 8 where they prove more extensive.

It must, however, be accepted that in contrast to Devasena, consciousness should be called as specific rather than general property. The rest of the properties are suggestive of material nature of the living. Its basic unit has all the qualities as the atom-like materials have. The single living unit is said to contain innumerable *pradeśas* with capacity for expansion and contraction. It has these *pradeśas* in an independant and

real sense. They are invisible because of fineness and therefore sense-imperceptibility or non-materiality of the living in contrast with the visible part of the gross matter. It is also said that the living one is partless but even a single part is made up of innumerable space-points. These represent its approximate size or extension. The space-points of the living belong to two categories – fixed and movable[82]. It is said that there are eight central space-points in a single living unit which are fixed. Others are movable during expansion or contraction by extirpation or interpenetration.

It has also been pointed out that the living one always resides in a body in the world. Hence, its size or extension depends on the size of the body. This extension applies only to *Jīva* – the worldly living due to karmic particles associated with it. The pure living unit might be devoid of extension and therefore, a non-existent reality as Jain[83] has pointed out.

The real spacepoint nature and extension of the living extends to the idea about the property of weight. Because of its extreme fineness, it must have negligible weight, empirically said to be weightless. Jain[84] has indicated the inverse relationship between extension and density which is its necessary accompaniment, pointing out indirectly the low density and hence finest weight of the basic living reality.

Table 8 : General and Specific Definitions/properties of Living.

No.	Source	General	Specific
1	*2*	*3*	*4*
1.	*Bhagavatī*	23 (with 7 repeatitions, Table 2)	–
2.	Kundakunda	17 (Table 2)	–
3.	Umāsvāti	(a) Existentiality (permanence through change)	(a) Five thought activities

1	2	3	4
		(b) Qualities and Modes	(b) Upayoga/Consciousness (conation/knowledge)
4.	Akalaṅka	11	As in 3 above
		(a) Existence	
		Changeability	
		Particulate nature	
		Non-materiality	
		(b) Differentiality	
		Actorship	
		Enjoyership	
		Non-pervasivity	
		Beginningless bonding	
		Permanance	
		Up-goingness	
5.	Devasena	8	6
		(a) Existence	Knowledge
		Substantiality	Conation
		Particulate nature	Happiness
		Non-materiality	Energy
			Non-materiality
		(b) Space occupancy	
		Weightlessness	
		Knowledgeability	
		Consciousness	Consciousness
		General nature 11	Special natures 10

Current Scientific Concepts About Living Reality

The scientists of today have mostly come to the conclusion that the first life on earth was evolved accidentally and spontaneously from complex combination of inorganic matter. Later on, it has been the rule that the living produces the living of its own species. They have now characterised the living reality with respect to its structural and functional aspects

on the basis of cell theory initiated in early nineteenth century. These characteristics are based on physical or mechanical concepts rather than the vitalist one. They are given in Table 9. These scientific concepts have no place for non-materiality, indestructibility of the living element. There may, however, be genetic continuity through transformability.

Table 9 : Scientific Concepts About the Living.

Scientific characteristics	Āgamic terms	Comple-tions	Vitalities	Instincts
1. Food, nutrition metabolism	–	Food	–	Food
2. Cellular structure (protoplasmic)	*Pudgala Astikāya*	body	Physical strength	–
3. Body organisation	Multi-pradeśi	–	–	–
4. Birth	Jantu	–	–	–
5. Growth	–	–	–	–
6. Movements (spontaneous, induced)	Jagat, Hinduka Ātmā, Upakrama	Senses	Physical Strength	–
7. Respiration	*Prāṇī*	Respiration	Respiration	–
8. Excretion	*Prāṇī*	Respiration	Respiration	–
9. Reproduction	*Yoni*	–	–	Sex
10. Irritability	Vijña, Veda	mind	Mental strength	fear
11. Adaptation	–	–	–	–
12. Death	Jīva	–	Age	–
13. Life cycle	–	–	–	–
14. Shape/ form	–	–	–	–

The scientific livingness consists of cells of the size

invisible to the eye (10^{-4}-10^{-6}cm.) but visible under fine microscope. These cells have a very complex structure made up of few common elements. This complexity may be guessed when one finds that one of the lowest living tobacco mosaic virus has 2000 column-shaped molecules each containing 158 amino acids of 16 varieties, its core consisting of 6502 nucleotide molecules making for its genetic speciality[85]. It has been estimated that a normal human body consists of about 10^{13} cells performing various functions. These cells have an average energy of 0.06 V. They form tissues, tissues form nerves and various organs and these form the complex organism[86]. The scientists have not only identified the compounds in the living units, but they have also been able to prepare some of them in their laboratory. That is why they are now in a position not only to create life in laboratories, but they can also produce Gandhis, Einsteins and Natwarlals at their will from the specific genes characteristic of these types of species[87]. They have genes banks for this purpose. These new experiments have created a stir in the minds of the east and west and they have started crying that these experiments should be prohibited. There will be chaos in the world as they directly effect their religious beliefs.

This scientific concept about the living leads to material nature of the living element suggestive of equating cells with the Jaina life element. It reminds us of the materialistic philosophers but it seems to be more accurate and fine one. It would, thus, mean that human body has not one but 10^{13} living units in performing and co-ordinating their functions remarkably and independantly. This concept also leads to microscopic perceptibility of the life element. But these inferences do not find support from canons as far as the pure life element is concerned. The worldly living, however, satisfies these inferences as it is material and ultra-sense-perceptible. Despite this, it must be added that the equation of the terms *arbuda* (lump of mass) and *romakūpas* (skin-pores) with

cells of the scientists by Sikdar is an over stretch for the cellular theory in canons (Jaina Biology, p. 28).

Formerly, the scientists presumed energies to be of non-material nature following the conservation law. Thus, the canonical pure life element could be said to be in the form of energy rather than cells. However, Jainas have always advocated energies to be material though they may be sufficiently finer than cells. The current science has also confirmed interconvertibility of matter and energy. Accordingly, the life element may be assumed to be of energetic nature whose non-materiality may be defined in terms of sense-imperceptibility. This assumption has been confirmed by scientific experiments which have shown that a newly born baby is associated with a charge of approximately 500 V of electrical energy and at death, the charge is nearly vanished, no body knows at present where does this charge go at death[88]. It is, however, presumed that this charge may be hoovering round the dead for sometime. This leads us to the fact that the living element is a form of fine energy particles called fine *kārmic* particles of luminous (electrical, caloric) or kārmic bodies by the Jainas. The recent telephonic talks (Spirocom) with spirits of the dead by O'neil and Meck also suggest a similar view of life element to be made up of fine light waves[89]. This association of fine bodies with the living makes it material. The maximum number of properties described in canons and *Dhavalā*[90] also support this view. The computers are another example to support material generation of knowledge of the desired nature. That is why, the physical brain of man is called one of the most efficient and complex natural computer.

It must, however, be noted that whether the canonical life element is assumed as cellular or energetic, there is no interference or effect on its important properties. Both concepts can explain the effects and changes in thought activities, knowledge and energy of the living unit due to cellular denaturation, mutation or elimination. The philosophers could think a differ-

ence between the pure and worldly living. The scientists are, however, not in a position to prove this. They have only one type of living unit – the worldly one about which the philosophers have described nearly the same way as the scientists. Lodha[91] refers to *Jīvābhigama, Prajñāpanā* and *Bhagavatī* to show that about eight important characteristics of the living are included in the concept of completions and vitalities as shown in table 9. The vitality of age/duration may mean death also. The irritability may be taken as first stage of consciousness.

Despite the fact that canonical eternality of pure living does not involve birth, growth and death phenomenon, the worldly one has these characteristics of life as shown in *Bhagavatī*. The common man also observes that there could be no new worldly living entity until it has birth through any of the processes. Besides, the canons have also described growth and death phenomenon. Summing up the contents spread over in different canons, it is found that almost all the scientifically essential characteristics of the living are traceable there and they seem to have mostly material approach. The para-psychologists and accounts of previous births did seem to give a setback to the scientists view[92]. However, Khushavant Singh categorically denies the correctness of these descriptions mentioning this as the cause of closure of para-psychology department of Rajasthan University in the later seventh decade of this century[93].

All scholars appreciate canonical contents about the definition of the living on the basis of current biological findings. It seems, however, that these contents mostly refer to externally observed facts. They keep mum over the why and how of these facts. They tell us about five bodies of gross and fine nature but there is nothing about their physical, chemical or physiological functions. They have respiration, but there seems to be nothing about the nature and composition of inhaled or exhaled gases or substances. It is said that food affects the functions,

activities or emotions, but its structural causation is missing. These examples could be multiplied. It is possible to conclude that canons represent an age of physical observation and mental conceptualisation. The current age represents an era of experimentation and instrumental examination which has added many finer details to the canonical contents and some newer facts also. It has given better insight into various aspects of life.

Of course, it will have to be admitted that the observation power of the Jaina seers seems to be quite advanced over other contemporary philosophies. In most cases, their observations have been verified and supported but in some cases they have to be re-examined and retold. Though the observational process represents one of the three steps for scientific knowledge, but natural observation and the same through instruments and objected experiments makes a difference. The gap between the two must be recognised and the results will represent a measure of intellectual growth of mankind between the canonical and current age. There would have been much progress in biological field if the Jainological contents could be known to the scientific community of the world during earlier centuries.

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Chapter 13

Classification and Life Cycle of Living Beings

The general livingness has been evaluatively defined in the previous chapter. Despite the difference of opinion regarding its earliest origin, many other canonical characteristics seem to be similar to those accepted by current scientists. Of course, they have added many new dimensions and finer details of the living units. Besides the definition, the canons and post-canonical literature has a variety of classification for proper studies of the living. Though, as Mahāprajña[1] says, it is very difficult to trace the order of developments in various trends of classification, still one can try to assess about their different types.

Six Groupings of the Living

The first book of the Jainas –*Ācārāṅga* has two classifications (1. 2,1. 9) based on the primary concept of six types of living groups. *Sūtrakṛtāṅga* gives three types of such groups with modifications in each with advancing sections (1. 7, 1. 1, 9. 11) confirming the six groupings. *Daśavaikālika*[2] maintains six groupings but the earlier section 4 follows the first *Ācārāṅga* grouping while section 8 follows its second grouping. *Uttarādhyayana*[3] follows the first *Ācārāṅga* grouping with some difference assuming air and fire bodies as mobiles like *Jīvābhigama*. In contrast to the six grouping concept, *Ṣaṭkhaṇḍāgama* and *Mūlācāra*[4] maintain seven groupings with the addition of unembodied living beings or liberated beings. All the above groupings have been summarised in Table 1. *Mūlācāra* mentions that the worldly living ones are of six types only as in canons.

Table 1 : Six groupings of the Living Beings

No. Source	No. of Grouping	Name
1. *Ācārāṅga,* 1. 2	6	(Earth, water, fire, air) bodies, plants, mobiles.
2. *Ācārāṅga,* 1. 9	6	(Earth, fire, water, air) bodies, (seeds, green plants, algae), mobiles.
3. *Sūtrakṛtāṅga*	6	*Rākṣasa, Yamalaukika, Asura, Gandharva, Khecara, Sthalacara.*
4. *Sūtrakṛtāṅga,* 1. 7	6	(Earth, fire, water, air) bodies, (trees, seeds, grass), Mobiles (Incubatory, umbilical, juical, sweatal).
5. *Sūtrakṛtāṅga,* 1. 9	6	(Earth, fire, water, air) bodies, (trees, seeds,grass etc. 10), (incubatory, umbilical, un-umbilical, juical, sweatal, ground sprouts).
6. *Ibid* 1. 11	6	(Earth, fire, water, air) bodies, (grass, seeds etc. 10) mobiles.
7. *Daśavaikālika,* 4	6	(Earth, fire, water, air) bodies, plants, mobiles.
8. *Daśavaikālika,* 8	6	(Earth, fire, water, air) bodies, (grass, tree, seeds etc.), mobiles.
9. *Uttarādhyayana,* 36	6	(Earth, water) bodies, plants, mobiles, (air,fire, intentional mobiles).
10. *Ṣaṭkhaṇḍāgama,* 1. 39	7	(Earth, fire, water, air) bodies, plants, mobiles, unembodied livings.
11. *Mūlācāra*-1, 204	7	(Earth, fire, water, air) bodies, plants, mobiles, liberated beings.
12. *Jīvābhigama*	7	(Earth, water, plants, air, fire) mobiles, liberated beings.

These groupings indicate the following points :

(a) They maintain the classes of living as six with exception in ref. 9, 10, 11.

(b) The terms *'trasa'* (mobiles) and *'Sthāvara'* (non-mobiles) seem to be coined later, though some references above use the term 'mobiles', some have varieties of mobile category without the term. However, there is no term *'sthāvara'* (immobile) used in these earlier groupings. *Jīvājīvābhigama*[5] seems to be the first to use the terms for worldly living beings.

(c) *Sūtrakṛtāṅga* seems to have developed from 4 mobiles in 1. 7 to six mobiles in 1. 9 while *Ācārāṅga* mentions eight mobiles separately[6]. This difference seems to be little disturbing to be explained. *Sūtrakṛtāṅga* 1. 12 also contains another grouping of six which may be earlier than the current one.

(d) The term *'Vanaspati'* (Plants) also seems to be a later coin as most references give names of different parts (upto 10) of the plants rather than plants in general.

(e) Besides reference 9 and 10, *Prajñāpanā* and *Jīvajīvābhigama* also mention the category of liberated beings. However, they have six varieties with reference to the worldly beings only as in *Mūlācāra*. There is no mention of them in the first book. Does it mean that the concept of liberation and the liberated is a later one ?

It is because of these points that an accurate successive development of the six groupings concept can not be traced.

However, one can decipher the two classes of living beings out of these six. Mobile living beings form one class. The rest five form the other class of, say, immobiles. *Ācārāṅga* has used the terms 'immobiles' in the end in 1. 9 only. Of course, it has used the term 'mobiles' in its groupings earlier. However, *Sūtrakṛtāṅga* and canonical contents in *Samavāo* mention a parallel classification of living beings in these two groups. Though this tradition of mobile-immobile groups is not

followed by *Prajñāpanā*[7], but *Jīvajīvābhigama* and later pro-canons follow it. In contrast, *Prajñāpanā* gives sense-based classification of the worldly beings which seems to be an earlier version of *Jīvajīvābhigama,* though it classifies the mobiles on this basis leading to an indirect conclusion of other beings as one-sensed. Jaggi[8] points out that sense-based classification of the living ones by the Jainas shows sufficient advancement over Caraka and Vaiśeṣikas. Of course, it cannot stand the specificity of the current binomial system of Linaus.

It must, here, be pointed out that *Jīvajīvābhigama* does not specifically mention the canonical six-fold groupings despite specific sections in D. S. V., U. T. N. in this regard. Theoretically, the grouping is termed as hylozoic concept, subject to large amount of criticism by scholars like Jacobi[9] and Khushawanta Singh. Current science also does not support the livingness of structurally simple elements or compounds even under earth's crust like earth, water, fire, air[10]. In contrast, the basic unit of livingness like protoplasm is a highly complicated structure found in plants and animals and not found in earth etc. *Bhagavatī* and other canons have pointed out many properties of simple bodies including their dormant consciousness and pain-feeling capacity dealt elaborately by Muni Mahendra Kumar in a recent article[11]. He seems to believe them on the authority of the omniscients and not of scientists. He seems to support Guṇaratna's contention of relationship between internal or external heat and livingness[12]. This logic seems to support the hylozoistic concept of Jainas. Nevertheless, much of his logistics has a confusing taste. Further, most of the details are not subject to scientific verification for charactersing livingness in simple molecules or mixtures.

Plants and Animals

The above two-fold classification continues to hold the field. Plants and animals have always been assumed to be living since hoary past. This is akin to current Botany and Zoology of biologists. However, one is not in a position to equate this

with the other two-fold classification of beings with mind and without or undeveloped mind[13]. Botany deals with plant kingdom only while zoology may be taken to include living ones with or without canonical mind. They include from fine insects to animals and other mammals. This is a little subtle classification requiring better elaboration. Moreover, scientists find some exceptions in each class due to recent researches. Some exceptions were noted by Jaina scholars too[14]. For example, a foetus in the womb which does not seem to move and a cyclone which moves fast. Such cases have been explained on the basis of *karma* theory in canons.

The characteristics of plants and non-plants are given in Table 2 as described in Jaina canons alongwith current points. It is clear that canonical points belong mostly to pre-instrumental era. They do not include the three modern characteristics of plants : (a) occurrence of chlorophyl, (b) cellular and cellulosic structure and (c) auto-feeding habits. Similar points regarding animals are also absent. However, the sexual pro-creation and open/semi-open seeding and some other points were known to Jainas even in 10th century which are micro-scopic contributions in science. The table 2 indicates that the scientists are peeping into internal points while the canonists are mostly externalists.

Table 2 : Canonical and Scientific Characteristics of Plants/ Animals.

1	Plants/non-mobiles 2	Animals/mobiles 3
[*A*] *Canonical*		
1. Nature (locomotion)	They are non-mobile (except a few)	They are mobile
2. Reproduction	A-sexual	Sexual/a-sexual
3. Types	18	15
4. Ovum	Closed	Open
5. Species	24 lacs	24 lacs (excluding

1	2	3
		hells/celestials)
6. Form-1	Macroscopic/visible	Visible/invisible
7. Form-2	Fine/gross, varied shapes	Gross only, fixed shapes
8. Families	28×10^{12}	81.5×10^{12}
9. Sex	Neuter	Male, Female, Neuter
10. Vitalities	4	5-10
11. Senses	1 (touch)	upto 5 with/without mind
[*B*] *Scientific*		
1. Species	*5 lacs*	app. 1 million
2. Cell wall	Cellulosic cell wall	not found
3. Nutrition	Auto-feeding	Non-auto-feeding
4. Nature of food	Fluid	Solid and fluid
5. Chlorophyl	Found	Not found
6. Irritability	Slow	Fast
7. Life processes	through non-specific parts of the body	through specific parts in the body
8. Growth	Continuous through out life, mostly vertical	S-shaped, lateral
9. Food storage	In the form of starch	In the form of glycogen
10. Energy source	Sun	Food
11. Excretion	No excretory organs	Excretory organs

Other Classifications of the Living

Dale Rieppe like Khushavanta Singh[15] has pointed out Lord Mahāvīra and his disciples as specialists in enumeration, compartmentalisation or classification. Accordingly, the six-fold canonical classification of living beings has many short and long

forms ranging the classes of the living from 1 to ten, 14, 24, 32, 57, 98, 190, 380, 406, 570, etc. This has been made possible by use of clever mathematical computations. These classes are not found in canons but pro-canons like *Jīvajīvābhigama* and texts like *Jīvakāṇḍa* (10th century) and *Jīva-vicāra-prakaraṇa* commentary (16th century) do have it. We will give here the enumerated classification from different sources in Table 3.

On looking at table 3, one finds that there have been many simple and mixed bases of classification of the living. They include senses, destinities, embodiments, gender, knowledge, forms or sizes, completions, activities, movements and qualities like conation, restraint, passions, libido etc. The bases do not include life-cycles, morphological and structural similarities and successive developmental stages. However, it is also clear that the current biologists have no classification based on senses or qualities etc. per chance because of their scientifically unverifiable nature.

It is also observed that these types of classification also involve sub-classification of various living beings. Because of this, the types or classes of living beings have increased. However, it could be taken that the living beings are basically classed in three groups – mobiles, immobiles and the liberated ones. There are some discussions in literature about the liberated beings to be called as living as they have neither embodiments, nor vitalities. *Dhavalā*[16] points them to be living formally rather than really. In contrast, Akalaṅka[17] points out the liberated ones to be living on three counts – (i) occurrence of psychical vitalities like knowledge, conation etc. (ii) earlier livingness prior to liberation and (iii) conventionally just like to call an animal as cow (*gau*-moving) even when it is not moving. However, they are being classed as living ones since *Prajñāpanā* days.

In contrast, the scientists do not agree for these salvated beings, they are beyond the sphere of their experimenta-

Table 3 : Different Classes of Living Beings.

No. Source	No. of Classes	Names
[A] *One Class of One Type :*		
1. Gommaṭasāra (J)	1	Jīva or general living.
[B] *Two Classes of 19 types :*		
1. Jīvābhigama	2 (state)	(i) Liberated, (ii) Worldly.
2. Jīvābhigama	2 (movement)	(i) Mobiles, (ii) immobiles.
3-15. Jīvābhigama	2 (13 types)	With reference to : (i) liberation, (ii) senses, (iii) body/bodily activities, (iv) functional activities, (v) libido, (vi) passion, (vii) colourations, (viii) knowledge, (ix) intakes, (x) speech, (xi) embodiment, (xii) last-timed, (xiii) applied consciousness.
16. Prajñāpanā	2 (state)	(i) Liberated, (ii) Worldly.
17. Jīva Vicāra Prakaraṇa	2 (state)	(i) Liberated, (ii) Worldly.
18. Jīva Vicāra Prakaraṇa	2 (movement)	(i) Mobiles, (ii) Immobiles.
19. Gommaṭasāra Jīvakāṇḍa	2 (movement)	(i) Mobiles, (ii) Immobiles.
[C] *Three Classes of Nine Types* :		
1. Jīvābhigama	3 (outlook)	(i) Right faithed, (ii) Worng faithed, (iii) right-cum-wrong faithed
2. Jīvābhigama	3 (duration)	Limited, unlimited and limited-cum-non-limited duration.

3.	Jīvābhigama	3 (completion)	Completioned, non-completioned, completioned-cum-non-completioned
4.	Jīvābhigama	3 (size)	Fine, gross, non-fine-non-gross.
5.	Jīvābhigama	3 (mind)	Rational, non-rational, non-both.
6.	Jīvābhigama	3 (liberatability)	Liberatable, non-liberatable, non-both.
7.	Jīvābhigama	3 (movement)	Mobiles, immobiles, non-both.
8.	Jīva-vicāra-prakaraṇa	3 (gender)	Males, females, Hermaphrodites.
9.	Gommaṭasāra Jīvakāṇḍa	3 (sense)	1-sensed, deficient-sensed, All-sensed.
[D] *Four Classes of Six Types* :			
1.	Jīvābhigama	4 (activity)	Active (mentally, vocally, bodily), Devoid of activity.
2.	Jīvābhigama	4 (libido)	Libido (male, female, neuter), Non-libidoed.
3.	Jīvābhigama	4 (conation)	Conation (Visual, non-visual, clairvoyant, perfect).
4.	Jīvābhigama	4 (restraint)	Restrained, non-restrained, Mixed, non-restrained-cum-non-non-restrained.
5.	Jīva-vicāra-prakaraṇa	4 (destinities)	Hellish, human, sub-human, Celestial.
6.	Gommaṭasāra Jīvakāṇḍa	4 (senses)	1-sensed, deficient-sensed, rational, non-rational.
[E] *Five Classes of Five Types* :			
1.	Jīvābhigama	5 (destinity)	4 as in D-5, liberated.
2.	Jīvābhigama	5 (passions)	(Anger, puff, deceit, greed) passioned, non-passioned.
3.	Jīva-vicāra-prakaraṇa	5 (senses)	1-5 sensed livings.

4.	Gommaṭasāra Jīvakāṇḍa	5 (senses)	1-5 sensed.
5.	Prajñāpanā	5 (senses)	1-5 sensed.

[F] *Six Classes of Five Types* :

1.	Jīvābhigama	6 (senses)	1-5 sensed, sense-devoids.
2.	Jīvābhigama	6 (bodies)	Gross-bodied, (transformable, ejectable, luminous, kārmic) bodied, Dis-embodied.
3.	Jīva-vicāra-prakaraṇa	6 (embodiments)	(Earth, water, fire, air) bodied, Plant bodied, Mobiles.
4.	Gommaṭasāra Jīvakāṇḍa	6 (embodiments)	(Earth, water, fire, air) bodied, Plant bodied, Mobiles.
5.	Sthānāṅga	6 (knowledge)	1-5 knowledge, 6 non-knowledge.

[G] *Seven Classes of Four Types* :

1.	Jīvābhigama	7 (embodiment & movements)	6 as in F-3, dis-embodied.
2.	Ṣaṭkhaṇḍāgama	7 (embodiment & movements)	6 as in F-3, dis-embodied.
3.	Gommaṭasāra Jīvakāṇḍa	7 (embodiment & movements)	(Earth, water, fire, air) bodied, Plant bodied, deficient-sensed mobiles, all-sensed mobiles.
4.	Jīva-vicāra-prakaraṇa	7 (destinities, gender)	Hellish, male sub-human, female sub-human,male human, female human, male celestial, female celestial.

[H] *Eight Classes of Four Types* :

1.	Jīvābhigama	8 (Destinities)	7 as in G-4, salvated.

2.	Jīvābhigama	8 (knowledge)	(Sensory, Verbal, Clairvoyant, telepathic, perfect) knowers, (sensory, verbal, clairvoyant) ignorant.
3.	Jīva-vicāra-prakaraṇa	8 (destinities)	(Hellish, sub-human, human, celestial) at first and non-first moment.
4.	Gommaṭasāra Jīvakāṇḍa	8 (senses)	(Earth, fire, water, air, plant) bodied, deficient-sensed, rational, non-rational.

[I] *Nine Classes of Three Types* :

1.	Jīvābhigama	9 (senses/destinity).	1-4 sensed, hellish, sub-human, human, celestial, salvated.
2.	Gommaṭasāra Jīvakāṇḍa	9 (senses/ mobility)	(Earth, fire, water, air, plant) Bodied, 2-sensed, 3-4 sensed, 5-sensed.
3.	Jīva-vicāra-prakaraṇa	9 (senses/ mobility)	(Earth, fire, water, air, plant) Bodied, 2-sensed, 3-4 sensed, 5-sensed.

[J] *Ten Classes of Five Types* :

1.	Jīvābhigama	10 (senses/ destinity)	9 as in I-3, non-sensed (Sense-devoids).
2.	Jīvābhigama	10 (destinity)	8 as in H-3, Salvated at first and non-first moment.
3.	Gommaṭasāra Jīvakāṇḍa	10 (senses/mind)	(Earth, fire, air, water, plant) bodied, 2-4 sensed, rational, non-rational.
4.	Jīva-vicāra-prakaraṇa	10 (senses)	(1-5 sensed) at first and non-first moment.

5. Sthānāṅga [38]	10 (senses)	1-sensed 5, 2, 3, 4, 5-sensed, non-sensed.
[K] *Eleven Classes* :		
1. Gommaṭasāra Jīvakāṇḍa	11 (mobility/forms)	1-5 gross immobiles, 1-5 fine immobiles, mobiles.
[L] *Twelve Classes* :		
1. Gommaṭasāra Jīvakāṇḍa	12 (senses, size, mobility)	1-5 gross immobiles, 1-5 fine immobiles, deficient-sensed mobiles, all-sensed mobiles.
[M] *Thirteen Classes* :		
1. Gommaṭasāra Jīvakāṇḍa	13 (sense, mobility, mind)	1-5 gross immobiles, 1-5 fine immobiles, deficient-sensed mobiles rational, non-rational.
[N] *Fourteen Classes of Two Types* :		
1. Gommaṭasāra Jīvakāṇḍa	14 (sense/ mobility)	1-5 gross immobiles, 1-5 fine immobiles, 2, 3, 4, 5 sensed beings.
2. Gommaṭasāra Jīvakāṇḍa	14 (completions)	Completioned and non-completioned (1-sensed gross and fine, 2, 3, 4-sensed, 5-sensed rational, 5-sensed non-rational).
[O] *Fifteen Classes* :		
1. Gommaṭasāra Jīvakāṇḍa	15 (senses/mind)	Gross 1-sensed 5, fine 1-sensed 5, 2, 3, 4-sensed, rational and non-rational 5-sensed.
[P] *Sixteen Classes* :		
1. Gommaṭasāra Jīvakāṇḍa	16 (size, sense)	1-8 gross and fine (earth, fire, water, air) bodied, 9-10

		permanent/variable life general plants - gross and fine, individual bodied plants, 14. Deficient-sensed beings, 15-16. Rational, non-rational.
[Q] *Seventeen Classes* :		
1. Gommaṭasāra Jīvakāṇḍa	17 (senses/size)	1-13 as in P-1, 14-17, 2, 3, 4, 5-sensed beings.
[R] *Eighteen Classes* :		
1. Gommaṭasāra Jīvakāṇḍa	18 (senses/mind)	1-16 as in Q-1, 17. Rational, 18. non-rational.
[S] *Ninteen Classes* :		
1. Gommaṭasāra Jīvakāṇḍa	19 (senses/mind)	1-12 as in P-1, 13-14. Supportive and non-supportive plants, 15-17. 2, 3, 4-sensed, 18-19. Rational and non-rational, 5-sensed.
[T] *Twenty-one Classes* :		
1. Pañca Saṅgraha	21 (completions/ senses, mind)	Completioned, non-completioned & structurally non-completioned classes of beings as in N-2.
[U] *Twenty-four Classes of Two Types* :		
1. Jīvābhigama Sūtra	24 (destinities/ activities)	Hellish, human, peri-patetic, astral, empyrean, 2, 3, 4, 5-sensed beings, 5 immobiles, 10 mansional celestials (based on daṇḍakas).
2. Dhavalā 1. 1	24 (completions)	Completioned and non-completioned states of (1-10. gross and fine, 5 1-sensed, 11. individual plants, 12. mobile beings).

[V] *Thirty Classes* :

1. Gommaṭasāra Jīvakāṇḍa	30 (mobility)	Completioned and non-completioned states of [1-10. gross and fine, 5 1-sensed, 11-15. mobiles (2, 3, 4 sensed, rational, non-rational)].

[W] *Thirty-two Classes of Two Types* :

1. Jīvābhigama	32 (states)	1-20 (gross and fine, completioned and non-completioned, 5 1-sensed) 21-22. completioned and non-completioned general plants 23-28. completioned and non-completioned 2, 3, 4 sensed 29-32. completioned and non-completioned, rational and non-rational 5-sensed.
2. Pañca Saṅgraha	32 (states)	1-16. completioned and non-completioned states of gross and fine 1- sensed. 17-22. completioned and non-completioned state of gross and fine general plants, individual plants. 23-32. As in W-1.

[X] *Thirty-four Classes* :

1. Triloka Prajñapti	34 (senses/form)	1-16. As in W-2. 17-24. completioned and non-completioned gross and fine general plants, supportive/non-supportive individual plants.

		25-34. completioned and non-completioned 2, 3, 4 sensed, rational, non-rationals.
[Y] *Thirty-six Classes* :		
1. Pañca Saṅgraha	36 (senses/form)	1-16. As in W-2. 17-24. completioned and non-completioned states of gross and fine permanent and variable general plants. 25-26. completioned and non-completioned individual plants. 27-36. completioned and non-completioned 2, 3, 4 sensed, rational/non-rationals.
[Z] *Thirty-eight Classes* :		
1. Gommaṭasāra Jīvakāṇḍa	38 (senses/mind)	1-38. completioned and non-completioned state of 19 classes as in S-1.
[AA] *Forty-eight Classes* :		
1. Pañca Saṅgraha	48 (completions)	1-48. Completioned, structurally and timal non-completioned states of gross and fine 41-sensed, gross/ fine general plants, individual plants, 2, 3, 4 sensed, rational/non-rational, 16 X 3 = 48.
[AB] *Fifty-four Classes* :		
1. Pañca Saṅgraha	54 (completions)	1-54. Completioned, structurally and timal non-comple-

		tioned varieties. Gross/fine forms of 4 1-sensed, gross/fine forms of permanent/variable general plants, Individual plants, 2, 3, 4 sensed, rational and non-rational, 5-sensed 18 x 3 = 54.
[AC] *Fifty-seven Classes* :		
1. Gommaṭasāra Jīvakāṇḍa	57 (completions, senses)	1-57. Completioned, structurally and timal non-completioned classes of 19 varieties as in S-1.
[AD] *Ninety-eight Classes* :		
1. Gommaṭasāra Jīvakāṇḍa	98 (Size/ completions)	1-51. Completioned, structurally and timally non-completioned [(1-8) gross/fine forms of 4 1-4 sensed, (9-12) gross/fine forms of permanent/variable general plants, (13-14) supportive/non supportive indivudal plants and (15-17) 2, 3, 4-sensed beings] = 17 x 3 = 51. 52-85. 5-sensed sub-humans of lands of action-30, Subhumans of lands of enjoyments-4. 86-98. Aryan humans-3, Non-Aryan humans-3, humans of best and worst lands of enjoyments-4, hellish -2, celestials-2.
[AE] *Four-hundred Six Classes* :		
1. Gommaṭasāra Jīvakāṇḍa	406 (completions, senses, mind)	1-81. Completioned, non-completioned and structurally non-completioned classes of gross/fine forms of 5 1-

		sensed, gross/fine forms of permanent/variable general plants, 10 Supportive/non-supportive individual plants, 2, 3, 4 sensed beings (27 x 3 = 81).
		82-123. 5-sensed sub-humans uterine 12, a-sexual 18, land of enjoyments 12.
		124-393. Completioned/structurally non-completioned classes of 135 celestials and hells (Mansional 10, peri-patetic 8, Astral 5, Empyreans 63, Hellish 49).
		394-406. Completioned/structurally non-completioned classes of uterine aryan, non-aryan, 3 types of enjoyment, lands, lands of action (human beings), 6 X 2 = 12, A-sexual aryan human beings.
[AF] *Mathematically Computed Classes* :		
1. Gommaṭasāra Jīvakāṇḍa	190	Refer 19 classes of S-1 19 + 1 = 20, 20/2 = 10, 10 X 19 = 190.
	380	Refer 38 classes of Z-1 38 + 2 = 40, 40/2 = 20, 20 X 19 = 380.
	570	Refer 57 classes of AC-1 57 + 3 = 60, 60/2 = 30, 30 X 19 = 570.

tion. They classify the living ones in two broad categories – (i) plants and (ii) animals. The plants represent the class of immobile beings. The scientists do not agree to the livingness of the first four canonical immobiles (earth, fire, water, air). Per chance, they have been taken as living by the Jainas due to substrate-substratum relationship. This animism of Jainas reflects the influence of Vedāntins. The scientists have differentiated the plants and animals on the basis of their visible characteristics and structures which have already been tabulated earlier. On sense-based canonical classification, the plants represent 1-sensed beings. The living beings under this category are said to number about half a million by scientists.

On the other hand, the animals represent living beings with 2-5 senses. They number about a million species. The scientists have classified both the living kingdoms on the three bases :

(i) *Natural System* : It is based on similarities of some natural characteristics and properties like morphology, structures and genus.

(ii) *Artificial System* : It is based on habitat, sexual characteristics and other properties.

(iii) *Phylogenic System* : It is based on phylum, internal structures and developmental similarities.

The Bentham and Hooker classification is most current for plants. It is based on natural system. Engler system is based on phylogenic system. The Linnaus system is an artificial system. He has also devised the current binomial nomenclature of plants in later half of eighteenth century.

The animals have also been classified on the basis of morphology, embryology, paleo-ontology and evolution etc. The classification of Store and Usinger is currently widely accepted[19]. Both these classifications will be comparatively given in due course. It may, however, be pointed out that the Jaina taxonomy has generally a mixed character.

Life-cycle of Worldly Living Beings : Birth, Growth and Death

All worldly living beings have a life cycle consisting of birth, growth and death phenomena. These processes are the most visible signs of life. They are not mentioned by Kundakunda (he seems to believe in pure, immortal beings like Vedāntins), but they are described in *Bhagavatī* and other canons and pro-canons. The birth represents the reproduction of the living followed by its growth and termination. There is sufficient material about these processes in Prākṛta literature which will be summarised here.

It has already been said that the livingness comes into existence due to the resultant growth of six completions. These are said to generate force, energy, vitality or heat for the functioning of life through metabolic change and observing its characteristics. The question is where do the first life symptoms in the worldly living arise from ? This has been one of the most complex question where difference of opinion even between various philosophies and sciences still exists and no decisive answer to it, as yet, could be given except various types of intellectual thoughts.

However, the successful synthesis of living cell in 1968 and production of genes in early seventies seem to be suggestive of material birth of primary life. A partial success in creating life in laboratory is visible but this will produce man, is very doubtful. This is because laws applicable to microworld are not as well applicable to macroworld. However, there has been a large amount of work on relating the complex proteins-RNA, DNA and other compounds with knowledge, memory and diseases. By introducing specific compounds, any of the above characteristics may be suppressed, denatured and modified. Dr. Kabra has reported many cases in this connection[20]. Volitional changes may also be covered through these inductions. Even changes in food habits lead to modify volitions. Jaina, however, seems to cast doubt on the success of scientists in this direction[21]. Still, the facts coming to light have a different

story to reveal.

The material origin of first living signs have also been the direct and indirect theory of Sāṅkhyas[22], Vaiśeṣikas[23] and even Vedāntins[24] who would tell us the birth of a body (of course, with livingness characteristics) rather than that of the living in the form of fine body (*liṅga* or *sūkṣma śarīra*). Cārvākas and Aristotle were also supporters of material origin of living. However, Vedāntins would console us by saying that birth and death are formal and secondary parts of the eternally living entity.

The Jainas have somewhat elaborately modified views on this point. They hold the commonsense view that the living beings have always been there as they are. They would proclaim that like begets the like and there seems to be no question of material origin of the living. Accordingly, it is not the living only, but the embodied living which takes a cellular beginning of life, the living cells being vegetatively, a-sexually or sexually transformed into a new or multicellular complex species of its own type. Partly they hold similar views like Vedāntins.

The Birth of the Living Beings

Whenever any species in the world appears in the form of new embodiment with the signs of livingness and vitalities, it is said to have taken birth. The Sāṅkhya and Nyāya schools also define the birth as a process of combination of consciousness (*Puruśa, Jīva, Prāṇa*) with the body or specific conglomeration of body, senses and intelligence. Jainas define it as having a new embodiment which is formed by assimilation of materials capable of transforming them into the body, senses etc. It is doubtful whether Pūjyapāda[25] means the soul as acceptor of matter for getting into a new body per chance in association with fine luminous and kārmic bodies (which he has not mentioned).

Many philosophies assume that the birth of a new species takes place by two possible mechanisms : (a) spon-

taneous generation has been the old way and (b) uterine birth is another way. The first involves the primary life from assumed non-living. The second involves living from the living one. These mechanisms may be equated to the a-sexual and sexual births in current terms.

The Sāṅkhyas believe in 18-elemental fine body to be born out of non-living *Prakṛti* which gets associated with the semen and blood of the parents and creates eight types of heavenly, five types of animals (deer, quadrupeds, birds, serpents and immobiles like plants) and one type of human lot[26], their conscious element being different whose mere presence and sight is supposed to be the power for their activities. This suggests that fine material body gets associated with the fine bodies only sexually (even in plants). This system, thus, regards uterine birth preceded by spontaneous generation of fine body. The Vaiśeṣikas[27] also agree to the two types of births of heavenly and non-heavenly bodies in terms of *ayonija* (a-sexual or special type) and *yonija* (uterine) births. They have a-sexual birth for heavenly bodies, seers, *ṛsis* and small crea-tures like moths, mosquitoes, gadflies, etc. due to merited or demerited atomic combinations. They have sexual births for mammals, birds and serpent etc. The sexual birth has two varieties : (i) umbilical (*jarāyuja*) and (ii) incubatory (*aṇḍaja*). The offshoots have sexual differentiation. The Vedāntins have two types of creatures : (a) mobiles and (b) non-mobiles. However, they have not specified their birth types in their earlier texts.

In contrast, the Jainas have three types of birth mechanism : (a) A-sexual or *Sammūrchima,* (b) Uterine or *Garbhaja* and (c) Special bed or *Upa-pāda* or *Ayonija* type[28]. The uterine birth has also been sub-classified in three forms – two of the Vaiśeṣikas and the third as un-umbilical one. They have exemplified all the three varieties as given in Table 4, showing birth types in three major Indian systems. This suggests the Jaina system to be advanced over others on two counts :

(i) Special provision of birth type for hellish and heavenly bodies, thus, distinguishing them from small creature (a-sexual) birth type.

(ii) Addition of a third variety of uterine birth for animals like lion, deers etc. indicating little finer observation power.

Table 4 : Different Types of Births in Three Major Indian Systems.

System	Birth types	Examples
1. Sāṅkhyas	1. Spontaneous followed by uterine birth	Heavenly bodies 8 Animals 5 Humans 1
2. Vaiśeṣikas	1. A-sexual (*Ayonija*)	Heavenly beings, ṛṣis, small creatures
	2. Uterine	
	(a) Umbilical	Men, animals
	(b) Incubatory	Birds, fish, serpents etc.
3. Jainas	1. A-sexual/ Spontaneous	1-4 sensed beings and some 5-sensed beings
	2. Uterine/Sexual (*garbhaja*)	
	(a) Umbilical	Men, 5-sensed animals
	(b) Non-umbilical	Lion, deers
	(c) Incubatory	Hen, parrot etc.
	3. Special bed (*Upapāda*)	Heavenly/hellish beings

The Jaina canons suggest that the present life comes into existence through the finest luminous and karmic type of bodies. These bodies have beginningless association with the living element. It is due to this that the livingness on earth is called as beginningless. However, the current life of the living comes into existence through the process of reproductive birth.

Bhagavatī[29] and other canons give a number of details about this process for human beings specially which have uterine umbilical birth as shown in Table 5.

Table 5 : Details of Uterine Birth Process.

No.	Item	Canonical	Current Science
1.	Intercourse	Destroys many embryo cells	–
2.	Potency period of cells	48 mts. – 9.6 hrs.	24-42 hrs.
3.	Pregnancy through Intercourse	1, 2, 3, to 2-9 x 10^5	Indefinite but mostly one
4.	Progenity of human beings	1, 2, 3, to 200-900	–
5.	Pregnancy period of water bodies	1 time unit to six months	–
6.	Pregnancy period of animals	48 mts. to 8 years	–
7.	Pregnancy period of humans	48 mts. to 12 years	App. 270 days
8.	Embodiment period in womb	48 mts. to 24 years	–

In contrast, such details are not available for a-sexuals. However, distinctive characters are given by Pūjyapāda and Akalaṅka[30] for a-sexual and sexual births as shown in Table 6. The a-sexual birth is spontaneous and macroscopic. Its species is short-lived and normally neuter in gender. Its causes and effects are visible. In contrast, the uterine birth may be either due to sperm and ovum in the womb or by assimilation of necessary foods etc. in it. The species are microscopic, invisible, long-living and gendered. Canonically, the sexually born species represent mainly the living ones with 5-senses and mind. However, *Prajñāpanā* mentions their a-sexual birth also. It is now known that for human beings, the embryos grow from 5 mm. in the first week to about 350 mm. in the end and

various developments take place from 12 weeks onwards. *Bhagavatī, Taṇḍulaveyalīya*[32] and other canons have pointed out many details about the period intervening bet-ween conception and birth known as pregnancy period given in Table 5. The maximum and minimum periodical limits have not been verified by the scientists. The canons also point out that there are psychic senses in the living cell at the point of conception rather than physical ones. It has an invisible fine body effected by outer environment – a fact agreed by current scientists[33].

Table 6 : Characteristics of Categories of Births.

No.	A-sexual	Uterine	Special bed
1.	Macroscopic	Microscopic	–
2.	Short lived	Long lived	Longer lived
3.	Cause-effect visible/ known	Cause-effect invisi-ble/unknown	–
4.	Neuter gender	Distinct gender	Distinct gender
5.	Formation of body in all directions	Formation of body by fusion of sperm and ovum in womb	Formation of body by trans-formable matters
6.	Open vagina	Open-cum-closed vagina	Closed vagina
7.	Hot, cold, hot-cum-cold vagina (hot for fire bodies)	Hot, cold, hot-cum-vagina	Hot and cold vagina
8.	Wet, dry and mixed vagina	Mixed vagina	Dry vagina
9.	–	Conch, tortoise & flat shaped Vagina	–

Types of Birth-places, their Number and Shapes

Table 6 shows that the Jaina canons have described about the types of birth-places, vaginas or wombs (*yonis*) in addition to the above birth mechanism. Normally, a birth place is a container of birth species for its proper development before it appears freely. Each species has its special types of birth

place. As many species, as many birth places. These are classified on the basis of many general conditions under which the living body is conceived and grows. The body may grow by assimilation of proper extracts or material from surroundings under suitable conditions of (a) covering, (b) climate and (c) temperature. The combination or reverses of these conditions make the total variety of birth places to be nine. The commentators of Umāsvāti's aphorism (T. S. 2. 32) have defined the word *'sacitta'* as place with living matter[34] which does not seem to suit here. It should mean climatic conditions like humid and dry or habitat.

The birth places have been referred to all kinds of living beings and one commonly knows that different plants and even animals have different types of environmental conditions for their nucleation and growth. The explaination of Pūjyapāda on mixed vagina is, thus, not convincing. Secondly, cellular genesis of life assumes livingness all the times during growth of lower or higher species. The T. S. commentators also seem to be off the track when they say that semen is non-living as it contains the cells and all the genetic code for growth of the living[35]. *Yaśodharacarita* does also seem anomalous when it mentions that livingness may accrue in the womb even a week after the union of sperm and ovum and that a father may become his own son[36]. The livingness enters the womb while concieving is another opinion for birth. This also does not sound scientific. Thus, a newer meaning of *'sacitta'* or the reverse will make Jaina description little more scientific.

Though the nine-variety classification of birth places is the simplest one, the canonists would tell us the number of birth places upto 84 lacs or 8.4 million like the Vedāntins based on classification of different living species. *Prajñāpanā* has different numeration, though *Malayavṛtti* calls *'saṅkhyāta'* as seven in many cases. This should be looked into. This means an another sense of the term *'yoni'* as a form of life which has a special birth-place. This is formalisation of cause into effect.

Thus, *'yoni'* does not only represent the birth-place but it also tells us about the different forms of living species. A third meaning of the term is also found in terms of cause of birth. This is, however, not generally agreed. Though the major *'yonis'* are four (hellish, human, sub-human and celestials), but their sub-classification yields 8.4 million *'yonis'* shown in Table 7 alongwith the number of families (specific species) of different species.

Table 7 : Number of *Yonis* and Families in Jaina Canons.

No.	Species	Yonis[42]	Families, $\times 10^{12}$ Mūlācāra[43]	PrV[44]
1.	1-sensed Earth-bodied	700,000	22	12
2.	1-sensed Water-bodied	700,000	7	7
3.	1-sensed Air-bodied	700,000	3	3
4.	1-sensed Fire-bodied	700,000	7	7
5.	1-sensed permanent general bodied species (plants)	700,000	–	–
6.	1-sensed variable general bodied species (plants)	700,000	–	–
7.	1-sensed other plant species	10,00,000	–	–
8.	Total plant species	24,00,000	28	28
9.	2, 3, 4 sensed species	600,000	24	24
10.	5-sensed animal species	400,000	43.50	53.50
11.	5-sensed human species	14,00,000	14	12
12.	Hellish species	400,000	25	25
13.	Celestial species	400,000	26	26
	Total	84,00,000	199,5	197.5

It is observed that there seems to be a discrepancy in the number of families of human beings in *Mūlācāra*[37] and *Gommaṭasāra Jīvakāṇḍa*[38] (one mentioning 14×10^{12} and the other mentioning as 12×10^{12}), thus, the families will vary between $197.5\text{-}199.5 \times 10^{12}$. *Gommaṭasāra* agrees with

Praśnavyākaraṇa[39]. This discrepancy must be removed. However, there is another discrepancy. Despite the number of families of the living beings of the same order, there is a difference in numeration in two places in non-Digambara version. There are $12x10^{12}$ earth-bodied families and $53.5x10^{12}$ families of five-sensed animals in comparison to 22 and 43.5 $x10^{12}$ families in Digambara version. This different numeration also requires clarification.

In addition to the number and types, *Prajñāpanā*[40] gives the shapes of the birthplaces also followed by other procanons. The birth places could be (a) conch shaped, (b) tortoise shaped and (c) bamboo leaf-like flat shaped. It is said that great men, kings and saints are born out of tortoise-shaped birthplace, common men are born out of flat birthplace and abortive birth takes place out of conch shaped birth place. The scientificity of these shapes has to be established. Jollies[41], however, points out five vaginal shapes, in terms of single medium (flat), duplex, tri-partite, leicarnuate and simplex types with illustrations.

The Growth of the Living Beings

The term birth generally refers to appear as a new embodiment. However, it is used in a wider sense here. It involves the process of conception or fertilisation followed by development of new nuclei in the new birth places upto a point of their appearance in the world. This is the first stage of growth. The second stage of growth involves the development of various parts of the physical embodiments to the full. This growth continues throughout life and ends only at death. It could be positive or negative. Both these stages are involved in the growth process here. Technically, this involves a quantitative increase in size, weight and volume at any stage.

Canons do not mention the difference between plant and animal growth. However, it is common-sense knowledge that plant growth is said to be continuous and more vertical than lateral. It is pointed out in *Sūtrakṛtāṅga* that plants grow

by taking and assimilating the sap from bodies of soil, water, air, fire (sun) and even other plants under favourable conditions[45]. This intake is caused through their outer skins from below and the sun and atmosphere from upwards. They have their intake through fine pores or hairs. They have energy intake by absorption and solution-intake by diffusion and osmosis. This all round intake causes the various completions (four in case of plants) which are instrumental in the growth of different parts of the plants. These are roots, tubers, stem, wall, sprout, branches, leaf, flower, fruits, seed and bark[46]. Each part has its intake by the same method through its underground roots with which every other part is connected. *Bhagavatī* mentions the growth of plants through intakes the amount of which vary from season to season[47]. Guṇaratna also points out similar growth process in plants alongwith many other comparable qualities of mammalians[48]. It is the intake which is transformed in different parts of plants in due course. Despite mention by Sikadar[49], canons do not seem to specify the quality of photosynthesis by plants and contribution of air in their growth. Of course, it could be inferred that the completional metabolism may supply the necessary energy for proper growth.

The growth of 1-4 sensed beings born through asexual or spontaneous mechanism is not very much detailed in canons, though quite a number of them have been said to be of uterine incubatory birth in contrast to their overall a-sexual origin[50]. But their growth after birth might be inferred as due to metabolisation of material intakes and consequent energy.

The growth of mammals during pregnancy period has already been described in another chapter. The after-birth growth is not very much detailed. But it has been pointed that the food intake is gradually metabolised to be transformed into blood, flesh, bone, fat, marrow, semen, sense-organs etc.[51] A mammalian passes into ten stages after birth. The first stage is that of a child (upto 10 yrs.). Other stages are : (ii) sportive stage, (iii) slow growth, (iv) youth or state of strength, (v)

family breeding, (vi) adulthood, (vii) old age, (viii) contracting stage, (ix) de-sexed stage, (x) sorrowful stage. Alternatively, ten growth states are also mentioned age-wise as below :

0-10	Age of sacraments & celebrations
10-20	Age of enjoyments
31-40	Age of earning experience
41-50	Age of weakening eye-sight
51-60	Age of weakening strength
61-70	Age of de-sexing
71-80	Age of weakening knowledge
81-90	Age of bending body
91-100	Age of departure/death

These stages suggest that Jaina seers could observe things from various angles. Normally, a 100 years age was assumed for men in the world. It is clear that some of the age-wise observations have to be redrafted in this century as many new points have come to be known.

Sex and Other Characters of the Progenies

For a-sexuals, the canons presume a neutral sex. However, for sexuals, they postulate that the sex of the progeny depends on the quantity of male semen, the relative excess of which procreates male species. Empirically, periodicity may also be an additional factor. Despite the fact that there was no idea about the constituents of semen in canonical days, this has a crude guess about the existence of chromosomes in semen.

It can also be surmised that the progeny should have characteristics of male and female partners as canons point that some parts (bones, hairs, etc.) are contributed by males and some (head and other parts) by females. Many volitional, intellectual and other characteristics of the progeny are said to be due to *kārmic* factors also which may be assumed to be transferred in the form of luminous and kārmic bodies through semen[52]. These bodies should contain what we call

genes today which characterise the parents in present and which may forecast the character of the coming progeny. In this respect, canonical *kārmic* theory may be equated with the genes theory, both being fine material aggregates. This equation, however, could not be taken too far.

Death of the Living Beings

Death is the termination of vitalities through any of the means described later. It is a natural phenomena and an unavoidable one. We can imagine the situation in the world in the absence of death of living beings. How horrible it could be until old age is reversed. Though there is no specific mention of causes of death of different types of living but the general causes given may be sufficient to judge the death of 1-5 sensed beings. The death may be due to physical (mostly) and mental causes. Times have changed and the number and variety of mental causes is increasing enormously. Concurrently, many more death-deterrants (like bye-pass surgery, implants and transplants, medication and meditation, etc.) are also being developed so as to delay the death phenomena. There a third type of death in Jaina practices – a type of voluntary death under extreme conditions with religious sanctions creating fearlessness about death[53]. Many scholars charge it with an equivalence of suicide but the Jaina seers have refuted it from the very beginning. This type of fearless and carefree death is a celebrity for a true Jaina.

The causes and types (17) of death are described with necessary supplementary material in relevant chapter.

Current Concepts About Birth

The biologists tell us that a new species is procreated by any of the three processes[54]

(i) Vegetative reproduction : Budding/fission	Bacillus
(ii) A-sexual reproduction : Endospores, conidia, cyst formation	Azobactor
(iii) Sexual reproduction : Conjugation, Transformation, transduction	Mammals & others

These processes represent the gradual evolutionary stages of evolution. The first two processes involve the natural process of procreation among the living when no sex-signs are evolved. They occur under favourable or unfavourable conditions. Despite some difference, both of these can be merged into one-a-sexual one. This method involves procreation not involving fusion of nucleii and meosis. It occurs by cell division, fission, budding and part-heno-genesis (for dipoloids). This is found only in low level living ones like virus, bacteria and non-flowering plants. The sexual method procreates the new species by mixing and fusion of the nucleii internally or externally from the same (tapeworm) or different species (of the same type, i.e., earthworm) called hermaphrodites. This is found mostly in flowering plants, animals and mammals. There are, however, a large number of species in lower plants and animals which are procreated by both these methods. The experimental verification of both types of births in many species of plants and animals is in sharp contrast with Jaina canons where mention of only a-sexual birth in plants and 1-4 sensed animals has been made[55]. Their birth does not involve sex in any way. Moreover, it seems that the term *'sammūrchima'* has not been very clearly defined. Should the a-sexuality of this birth be involving procreation of the first lowest form of life from the non-living materials spontaneously ? If so, it goes against the Jaina theory of non-destruction of soul and cause-effectism. It must, therefore, be defined to maintain these principles. In any case, it can not mean the earlier Cārvāka or later Aristotlean view. Yuvācārya has given a better definition stating it as a way of birth with no fixed place and womb[56]. It tries to clarify some points as refuting the spontaneous generation indirectly. However, looking the canonical descriptions, it seems that indirect or invisible sex should also be included in the term so that 1-4 sensed species of sexual procreation may be included in this class. Though this may not be correct scientifically as they would be called sexually procreated whether it may be direct

or indirect. This canonical point requires better definition of the term *'sammūrchima'*. Similarly, the canonical concept about hermaphroditic character of a-sexual living beings also requires re-examination under many scientific facts.

The canonical a-sexual birth of 1-4 sensed beings represents the first stage of livingness followed by more developed state of sexual birth. Thus, Jaina canons also believe in evolutionary process of developing level of consciousness as also mentioned by Sikadar[57]. The sexual procreation of scientists has direct or indirect fusion of two nucleii. The mammalian procreation is a direct sexual one. The microscopically visible procreation of many plants and lower animals is an indirect sexual one. This has been called a-sexual in canons. It suggests that canonical contents represent the visible points of observation of pre-microscopic age. However, on finer observations, later literature points out many animals of 1-4 senses to be incubatory and sexually procreated[58]. The question of practical and absolutist viewpoint on this matter and to call incubatory as a-sexual is just to forestall the growth front of accurate knowledge not in tune with the examination based Jainology[59]. This point leads to another fact that later authors have added newer informations whether they add or contradict the earlier statements.

Heredity Characters and Sex

The scientists believe that the basic progeny characters are supposed to originate and develop from many factors involving seminal and menstruation fluids (genetic source), sensory and nervous systems, glandular secretions, bio-electric and bio-chemical changes, internal and external surroundings and emotion-carrying electromagnetic or electrostatic stimulations[60]. They may be effective in various permutations and combinations involving mutational characters. Thus, an infinite variety of mental and emotional states and activities may originate in a species. Every living system has natural and circumstancial intakes of these factors for the resulting characters which have

been verified by the psychologists under medium range cases[61]. Though the scientists agree to the cause-effect principle of *karmavādins,* but they may not agree to past karmas as originators of present until the term *'karma'* has some reasonable conceptualisation in current terms. Material karmas (fine particles or waves) must be improvable by material medication, austeritic and intentional changes. That is why, Ohira has equated *karma* with any fine form of intake – physical (i.e., genes), vocal or mental. This equation may not be to the liking of *kārmic* theoreticians, but this seems to be the best way under the current set of knowledge to forestall the dwindling effect of this theory and giving it the credit of modernity. *Karma* cannot be a vital force. It could only be a material force subject to scientific studies.

The sex characters have been found to develop due to chromosomal specific pairing. This is a finer structural basis than canonical relative semen-excess base.

The canons have quite impressive details about sexual reproduction, embryo growth and growth after-birth regarding human beings which have been comparatively described in chapter on medical sciences.

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4. (b) Baṭṭakera : *Mūlācāra*-1, Bharatiya Jnanpitha, Delhi, 1984, p. 171.
5. *Jīvajīvābhigama,* S. Shastroddhara Samiti, Rajakot, 1971, p. 48.

6. Edited Madhukara Muni : *Ācārāṅga*-1, A. P. S., Beawar, 1980, p. 28.
7. Shyama Arya : *Prajñāpanā*-1, *Ibid,* 1983, p. 36, p. 43, p. 47, pp. 70-72 etc.
8. O. P. Jaggi : *Prācīna Bhārata ke Vaijñānika aur unakī Upalabdhiyāna,* Atmaram & Sons, Delhi, 1971, p. 186.
9. (a) A. Chakravarti : in *Pañcāstikāya-sāra,* Bharatiya Jnanapitha, Delhi, 1975, p. XVII.

   (b) Khushavanta Singh : View of India, I. B. H. Publishing House, Delhi, 1982, p. 54.

   (c) Svāmī Prabhavananda : Spiritual Heritage of India, Ramakrishna Matha, Madras-4, 1973, p. 155.
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12. Haribhadra Suri : Ṣaḍ-Darśana-Samuccaya, Bharatiya Jnanapitha, Delhi, 1971, p. 240.
13. Umāsvāti : *Tattvārtha Sūtra,* Varṇī Granthamala, Kashi, 1949, p. 90, p. 102.
14. Bhaṭṭa Akalaṅka : *Rājavārttika*-1, pp. 126-127.
15. Khushavanta Singh : *View of India,* p. 54.
16. Jinendra Varṇī : *Jainendra Siddhānta Kośa*-2, p. 334.
17. Bhaṭṭa Akalaṅka : *Rājavārttika*-1, p. 25.
18. Y. D. Tyāgi : *College Botany* (Hindi), Arun Prakashan, Gwalior, 1991, pp. 431-442.
19. R. N. Singh & A. K. Bansal : *Zoology* (Hindi), Yugabodha Prakashan, Raipur, p.155.
20. Dr. Kabra : *Ravivāra,* 9. 32, April, 1986, p. 44.
21. G. R. Jain : *Cosmology, Old and New,* p. 59.
22. Īśvarakṛṣṇa : *Sāṅkhyakārikā,* p. 94.
23. Praśastapāda : *Praśastapāda Bhāṣya,* p. 82.
24. (a) Śaṅkarācārya : *Brahma-Sūtra-Śāṅkara-Bhāṣya,* 1972, p. 495.

24. (b) Dīvānacanda : *Darśana-Saṅgraha,* U. P. Publications, Lucknow, 1958, p. 220.
Generally the conceived body is taken to be non-living by religionists and philosophers. There is, therefore, a problem to explain the livingness during embrgo or zygote stage. The Vedics believed that when a worldly being dies, the winds coming out of the dead move to transitional realms wherefrom they come to the earth through rains, get absorbed by plants eaten by males. Their semen, thus, has the livingness passing to the females through intercourse. The Buddhas presume the potential or rebirth linking consciousness of the dead arises at the precise moment of conception. The Jainas seem to have better face. They hold that the living one has a bonded life-span *Karma* and destinity during his third or last part of current life and as soon as he dies, his subtle Kārmic-luminous body moves to the requisite place of conception within 1-3 *samayas.* The transmigrating entity does not require much time to decide his next fate.
— O' Flaherty : Karma and Rebirth in Indian Tradition, MLBD, Delhi, 1983, p. 221, p. 229.
25. Pūjyapāda : *Sarvārtha-siddhi,* p. 134.
26. Īśvarakṛṣṇa : *Sāṅkhyakārikā,* p. 76, p. 104.
27. Kaṇāda : Vaiśeṣika Sūtra, pp. 288-289
28. Pūjyapāda : *Sarvārtha-siddhi,* pp. 134-135.
29. *Bhagavatī*-1, Jaina Bhavana, Calcuṭta, 1973, pp.185-187.
30. Bhaṭṭa Akalaṅka : *Rājavārttika*-1, pp. 134-135.
31. Shyāma Ārya : *Prajñāpanā*-1, pp. 80-90.
32. *Taṇḍulaveyalīya;* S. Hitakarani Sansthan, Bikaner, 1949, pp. 6-16
33. *Bhagavatī*-1, Jaina Bhavana, Calcutta, 1973, pp. 185-187.
34. Pūjyapāda : *Sarvārtha-siddhi,* pp. 134-135.
35. *Ibid,* pp. 134-135.
36. Jinendra Varṇī : *Jainendra Siddhānta Kośa*-2, p. 334.
37. Baṭṭakera : *Mūlācāra,* pp. 186-190.

38. Nemichanda Chakravarti : *Gommaṭasāra-Jīvakāṇḍa,* P. P. Mandal, Agas, 1972, p. 74.
39. Edited Madhukara Muni : *Praśnavyākaraṇa,* A. P. S., Beawar, 1983, p. 44.
40. Shyāma Ārya : *Prajñāpanā*-1, p. 36, p. 43, p. 47, pp. 70-72, etc.
41. Malcom Jollie : Chordate Morphology, East-West, Delhi, 1968, pp. 186-190.
42. Baṭṭakera, *Mūlācāra,* pp. 186-190.
43. *Ibid,* pp. 186-190.
44. Edited Madhukara Muni : *Praśnavyākaraṇa,* p. 44.
45. Edited Yuvācārya Mahāprajña : *Sūtrakṛtāṅga*-2, Jaina Vishva Bharati, Ladnun, 1984, p. 104.
46. Edited Yuvācārya Mahāprajña : *Ṭhāṇam,* p. 657, p. 943.
47. Edited Madhukara Muni : *Bhagwatī*-3, pp.1130-1132.
48. Haribhadra Sūri : *Ṣaḍdarśana-samuccaya,* p. 240.
49. J. C. Sikdar : *Jabalpur University Lectures,* 1975.
50. Bhadrabāhu : *Kalpa-sūtra,* Agama Shodha Sansthan, Sibana, 1968, p. 343.
51. *Taṇḍulaveyalīya,* pp. 6-16.
52. *Bhagavatī*-1, Jaina Bhavana, Calcutta, 1973, pp. 185-187.
53. Pūjyapāda : *Sarvārtha-siddhi,* p. 273.
54. (a) Tyāgī : *College Botani,* pp. 431-442.
    (b) Singh & Bansal : *Zoology,* p. 155.
55. Pūjyapāda : *Sarvārtha-siddhi,* p. 136.
56. Muni Nathamala : *Jaina Darśana : Manana aur Mīmāmsā,* Adarsha Sahitya Sangh, Churu, 1973.
57. J. C. Sikdar : *Jabalpur University Lectures,* 1975.
58. Bhadrabāhu : *Kalpa-sūtra,* p. 343.
59. Muni Nandighoshavijaya : *Tīrthaṅkara,* 1987, p. 63.
60. N. L. Jain : *Jaina Journal,* Calcutta, 1988, p. 133.
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Chapter 14

Botanical Contents in Prākṛta Canons

Plant kingdom forms the first variety of the worldly living in the middle portion of the Jaina universe. The plants represent the low level 1-sensed immobile or sessile living beings out of their two classes. They form about 38.6% of the total birth places and 14.2% of the total families of the living world. They include green grass, trees, creepers, shrubs, herbs, clusters, etc. All types of dry, wet, cut or uncut plants are called botanical species. They are primary products of the living world supporting higher life. They are called *'taru'* or safeguard for calamities and *'pādapa'* or growing through base or root actions. Amara Muni[1] has pointed out that plant kingdom has been important from : (a) individual (foods and medicines), (b) social (environments), (c) non-violence (vegetarianism) and (d) livelihood point of view. The trees have been associated with many attainments of the past great men (like attaining perfect knowledge under *sāla, baṭa* or *Bodhi* trees) and their sermonisation in gardens. Many names are associated with trees like *Jambū*-island, *Dhātakīkhaṇḍa* island, and *Aśoka* tree as special glorification of Jaina lords. It is said that people planting trees earn names. The afforestation festival has been a noted affair in the past.

Jaina scholars have studied plants and other living beings from two angles : (a) physical and (b) moral. The religious literature describes them mainly on the basis of their ethical values. Nevertheless, it contains sufficient description in physical terms about them. A large amount of details are found regarding the available plants, their classification and identification. They have been described under disquisition doors of many types. Table 1 gives some canonical informa-

tions under different disquisition doors[2] for the two main classes of plants. Only useful informations have been selected here. They have been described under senses, body, size, shapes, sex, activity, food, vitalities, completions, species, dwelling places, birth-places etc. together with many volitional aspects. This indicates the wide scope of studies Jaina scholars have made on plants. These descriptions, however, indicate that they have been concentrated on some specifically observable points in canonical periods. One does not find material regarding cellular structure, physiological metabolism, ecology, etc. which form the base of modern botany.

Table 1 : Description Under Disquisition Doors : Plant Kingdom*.

No.	Disquisition Door 1	Fine Plants 2	General Plants 3	Individual Plants 4
1.	Naming/definition	—	Common-bodied soul	Single-bodied-soul
2.	Numeration	Infinite	12 (infinite)	30 (innumerable)
3.	Fineness	—	10^{-15} cm	10^{-15} cm
4.	Position/station	Everywhere in the world	21 places	21 places
5.	Direction	←— North, South, East, West —→		
6.	Life-span	Innumerable cycles of time	48 mts. to 10,000 years	
7.	Body	3	3	3
8.	Modifications	—	Infinite	Infinite
9.	Shape	Irregular	Irregular	Irregular
10.	Bone-joints	6 th.	6 th.	6 th.
11.	Sex	Neuter	Neuter	Neuter
12.	Intake	Substantive, Locational, Timal and Modal by touch only.		
13.	Respiration	Occurs	Occurs	Occurs

1	2	3	4
14. Colours	5	5	5
15. Instincts	4	4	4
16. Speech	Indistinct, Non-speaking.		
17. Senses	1	1	1
18. Completions	4	4	4
19. Vitalities	4	4	4
20. Birth	A-sexual, Spontaneous		
21. Birth-places	Covered, All climates and Temperature		
22. Species	–	14 lacs	10 lacs
23. Extrications (*Samudghāta*)	3 (*Vedanā, Kaṣāya, Maraṇāntika*)	3	3
24. Destinity	Sub-human, Bi-departure, Bi-arrival		
25. Ownership	Self	Self	Self
26. Mind	← Dormant and Primitive Mind →		
27. Vision/Conation	←—— Non-occular Vision ——→		
28. Families	←—— 28×10^{12} ——→		
29. Colouration	3	3	3.4
30. Passions	4	4	4
31. Activity (*Yoga*)	Bodily	Bodily	Bodily
32. Appl. Consciousness (*Upayoga*)	← Determinate and Indeterminate →		
33. Feeling (Pain/ Pleasure	Yes	Yes	Yes
34. Kārmic Bondage, Sub-species	117	117	117
35. Attachment	Yes	Yes	Yes
36. Restraint	←—— Non-restrained ——→		
37. Spiritual Stages	First	First	First
38. Liberatability	Yes, through human destinity		
39. Knowledges	Wrong, Sensory and Verbal		
40. Faith	←—— Perverse Faith ——→		
41. Size/Accomodation	←—— 10^{-15} cm. –1000 Y ——→		

* Data collected from *Karmagrantha, Prajñāpanā, Jīvābhigama* and *J. S. K.* etc.

Livingness of Plants

Many philosophies do not agree the plants to be living, but the Jainas have been animistic from the very beginning. *Chāndogya Upaniṣad* also declared livingness of all types of immobiles even fire and water like the Jainas. Aristotle also pointed out semi-developed life in them. However, the Jainas have given observational points in support of their livingness. *Ācārāṅga*[3], *Sūtrakṛtāṅga*[4], *Mūlācāra*[5] and other canons have pointed out that plants are living because

(i-ii) They are born. They grow young and old.

(iii-iv) They get diseased and destroyed. They get faded/dry when cut.

(v-vi) They are healed, they get healthy when medically treated.

(vii-viii) They have desire for food. They have longings for pregnant women.

(ix-x) They have many modifications. They undergo metabolic changes.

(ix-xii) Some of them contract when touched. Some sleep in night and awaken in day.

(xiii-xiv) They have dormant consciousness. They have feelings of pain and pleasure when cut or grown like human beings.

(xv-xvi) They approach towards others through medium. Their bodies are temporary.

(xvii-xviii) They procreate similar species. They flower when treated by mouthwash of women and beaten by their feet.

(xix) The roots of some plants move towards wealth or treasure.

Mūlācāra points cut that the livingness of plants is confirmed cannonically as above, inferentially and by direct observations.. They have added some more points in this regard. They are like human beings with respect to their living-

ness (and hence one should be non-violent towards them). Of course, one must agree that their livingness is not so evident as in men but it is highly evident with respect to other immobiles. Besides livingness, other plant characteristics have been tabulated earlier.

Classification of Plants

Greek, Roman and Chinese scholars did classify plants from their utilitarian point of view in the form of shrubs, herbs and trees. The botanists of today do not recognise it as scientific. Looking to the number and variety of plants, their classification is most essential for their proper study. The basis of this has been similar properties, size, shape and structure etc. The scientific study of plants started only during later half of the 17th century and developments in physics and chemistry contributed towards their swift study. *C. Linnaus* of Sweden has been credited for current classification and binomial nomenclature of the plant kingdom.

Plants have been classified naturally on the basis of shapes of their leaves, environment, evolutionary similarities and chemical constituents. The utilitarian classification is supposed to be an artificial one. The botanists have gone a little deeper in classifying plants on the basis of their birth types or species and phylogenic basis. Though no system seems to be full-proof, however, a good amount of simplification has been done.[6]

Jaina scholars have classified plants on the natural basis, birth and birth-place basis. *Ācārāṅga* and *Sūtrakṛtāṅga* do not have any specific classification, but the earlier mentions fungi, green plants and seeds while the latter points out many varieties. However, *Sūtrakṛtāṅga* - 2 mentions five types of plants (trees, grasses, green vegetables, cereals and algae) sub-classified in 12 varieties on the basis of earth and water as their birth places[7]. *Daśavaikālika* describes eight types of plants depending on their types of growth, i. e., plants growing from : (i) roots (ginger, tumeric, etc.), (ii) shoots (rose,

flower, etc.), (iii) knots (sugarcane), (iv) stems (palāśa etc.), (v) Seeds (wheats, etc.), (vi) bulbs (onions etc.), (vii) climbers and (viii) self-growth[8]. The eighth type is the traditional type based on supposedly vital force or spontaneous generation theory. *Gommaṭasāra*[9] mentions only seven such types excluding 7. If we leave this one, all others are sexually growing. The botanists also say the same that plants belong to two categories : (a) non-flowering or a-sexual and (ii) flowering or sexual. The Jaina classification, thus, suggests how much similarity one observes between canonical and botanical plant classification. It might be true that in initial stages, Jaina scholars might be taking all the plants growing a-sexually, but later they must have observed their sexual growth in many cases. Basunandī[10] has clearly surmised this by stating plants to be of two types on the same basis : (i) sexually born out of seeds and (ii) a-sexually born. Moreover, *Mūlācāra* points out sexual and a-sexual births for many of the plant classes.

Physically, Jaina scholars have adopted another way of classifying plants a little more fundamentally leading to the above conclusion. It is based on some finer qualities of plants – the livingness content. Thus, plants belong to two types according to *Prajñāpanā* and *Jīvajīvābhigama*[11] : (i) fine and (ii) gross. The fine plants are found all over the world and they have a single variety. They may have spherical, flat or other shapes. The gross plants have two varieties : (i) general, bodied and (ii) individual bodied. *Bhagavatī*[12] classifies them in three varieties (numerable, innumerable and infinite bodied) which could be condensed into the above two classes merging the the first two in one class. In contrast to Śvetāmbara versions, the Digambaras point out the fine variety of general bodied plants only. Of course, they agree to the simple grossness of individual bodied plants even in T. P.[13]. Similarly, *Uttarādhyayana* points out that individual bodied plants are completioned only while the general bodied ones may be of both types[14]. In contrast, *Dhavalā* mentions individual bodied

plants also to be of both types[15]. Thus, there seems to be some difference between the Digambara and non-Digambara versions and also in different Śvetāmbara canons regarding sub-classification of general and individual bodied plants with respect to fineness and completions. The Digambaras start their classification with general and individual plants while the Śvetāmbaras start with fine and gross variety. The difference has not been clarified by later commentators also. These points are shown below :

Plant Category	General bodied plants	Individual bodied plants	Fine plants
1. Digambara procanons[16]	(i) Gross and fine	—	Fine
	(ii) Permanent & temporary	Completioned/ Non-completioned	—
2. Śvetāmbara version[17]	Gross form only	Completioned only	Completioned/ Non-completioned.
	Gross & Fine (Bhagavatī) (visible/non-visible)	—	—

This two-fold plant classification is in sharp contrast with that of the four-fold one of *Atharva-veda* which mentions plants as : (i) flowering, (ii) budding, (iii) fruity and (iv) non-fruity. However, these could be reduced to two by condensing (i) & (iii) and (ii) & (iv) which will be nearly equivalent to the two classes of the Jainas[18].

The general bodied plants are called *'nigotas'* or *'nigodas'* which means plants supporting many other plants or living beings. They are said to be multiple bodied, every embodiment being a living one. While *Bhagavatī* classifies the *nigotas* in two forms — fine and gross, other canons do not sub-classify them in this way. However, the Digambara canons sub-classify them differently in terms of : (i) permanent and (ii) temporary[19]. The permanent ones do not mutate while the others may move for higher levels of life. *Ratnākara*[20] has given

different names to these two classes, of course, with similar meanings. Though there is no gross and fine forms in Digambaras, but they mention fine plants as well as fine *nigotas* (general bodied plants). But *Dhavalā* points out that this different and contradictory mention could be solved only by the omniscients.[21] Thus, plants and *'nigotas'* may be same or different. However, we will presume *'nigotas'* as general bodied plants of fine and gross forms. The fine form has been equated as micro-organisms found everywhere in the world. It is also stated that the supporting individual bodied plants may also be called fine or gross *'nigotas'* on the basis of substratum-substrate relationship.

Prajnāpanā and other pro-canons define the general and individual plants with many characteristics as tabulated in Table 2.[22]

The general bodied plants are those species from which individual bodied plants are developed. Actually, the cells of these later plants are quite complex and they are produced by fusion or division of general plant cells. Thus, the general plants (or their cells) are the first primitive living organisms on earth. Canonically, general plants are those where many living elements are found in a common embodiment[23]. It is said that grow and die together. They take their food and respiration together. The canons presume the general plants to grow a-sexually or self-growing. The fine general plants are normally invisible and normally all-space pervading. The non-violent Jainas are asked "How do they call themselves non-violent in this micro-cosmically living world ?" The Jainas declare, "The question of violence is more of internal nature rather than physical"[24]. Śāntisūrīśvarajī[25] says that there is no harm done to fine general plants as they are elastic and non-collisible due to extra fineness of their bodies. However, it must be admitted that their reproduction, fineness, invisibility and their capacity to produce individual plants prove their basic nature to be of unicellular type class of today.

Table 2 : Characteristics of General and Individual Bodied Plants.

	General bodied plants	Individual bodied plants
1.	They go asunder together.	Properties 1-5 are individualised.
2.	They take the form together.	
3.	They take the food together.	
4.	They inhale/exhale together.	
5.	They have common holdings.	
6.	They have a common element of livingness like hot iron/gold mass.	They have seperated element of livingness in different parts behaving as one like the adhesively stuck mustard or sweet seasame cakes.
7.	The veins, joints, knots of the plants are not clearly visible.	Veins, joints, knots etc. are clearly visible.
8.	When cut, it is divided in two equal parts.	When cut, it is divided in two unequal parts/piths.
9.	When cut, no threads are seen in inner parts.	When cut, threads are seen in inner parts.
10.	They grow again even when cut and dried under favourable conditions.	It may not grow again when cut and dried under favourable conditions.
11.	Their bark is thicker than inner part.	Their bark is thinner than inner part.
12.	Individual plants are developed out of these plants.	—
13.	Generally flowers are general bodied.	Generally, other parts except flowers are individual bodied.
14.	Their number is infinite.	Their number is innumerable.

Physically, general bodied plants have hidden veins, joints and knots. They are equally divisible and threadless when divided. They are soft and they can grow even when cut. These

plants are called infinite-bodied (*ananta kāyika*) as there is active living element in each individual part of the plant which represents individual living cells present in each part. Bulbous vegetation (plants growing under ground), sprouts, tendril leaf buds, wood fungus, moss, mushrooms, ginger, carrot, algae, and the like are general plants. The canons have given about sixty three names of general plants in different texts shown in Table 3. These names are mostly given as found in texts as their equivalents are not easily available. While these names are given, it must be noted that in the early stage of growth from seed or otherwise, a plant remains non-supporting individual bodied upto about 48 minutes and then it becomes general bodied for a good length of time until signs of individual characteristics appear[26]. The later texts presume that it is very difficult to judge about the general or individual bodiedness of many plants. However, one could decide about it by closely observing the characteristics at any time.

The characteristics of individual plants are just opposite to those of the general plants. However, they have been sub-classified in two categories : (i) supporting and (ii) non-supporting ones[27]. The supporting individual bodied plants are those which are substratum of many general plants. The non-supporting ones are those which do not support other plants. They support themselves. They may be autotrophs.

All of them are gross bodied, though at nucleation stage, they might be microscopic. The livingness in these plants may be dormant or active. The actively living individual plants can give birth to a new species. During the stage of growth, every growing part of the plant is in an actively living stage. The life existing in its different parts is said to be fully completioned depending on the level of life. All the macroscopic plants come under this category.

The dormant-life plants behave differently. They dry when they are cut. It is presumed that every plant's life is dormant in its first stage of growth. It seems that this distinction

Table 3 : Names of General Plants in Different Texts.

No.	*Bhagavatī*, 23 1	*Jīvābhigama*, 22 2	*UTA*, 22 3	*Prajñāpanā*, 63 4	*Jīva-vicāra*, 32 5	*Mūlācāra*, 18 6	*Lati-saṁhitā*, 14 7
1.	Potato	Potato	Potato	Potato	Potato	Bulbous roots	Potato
2.	Radish	Radish	Radish	Radish	Radish	Sprouts	Radish
3.	Ginger	Ginger	Ginger	Ginger	Ginger	Bark	Ginger
4.	Turmeric, gr.	Turmeric	Turmeric	Turmeric	Turmeric	Soft leaf	Soft leaf
5.	Horse-eared plant	Horse-eared plant	Horse-eared pl.	Horse-eared plant	—	Stem	—
6.	Siṅghakarṇī (Bulbous)	Siṅghakarṇī	Siṅghakarṇī	Siṅghakarṇī	—	Fruits	—
7.	Musuṇḍī (lined root)	Musuṇḍī	Musuṇḍī	Musuṇḍī	—	Flowers	—
8.	Kittikā	Kittikā	—	Kittikā	—	Clusters	—
9.	Bajrakanda	Bajrakanda	Bajrakanda	Bajrakanda	Bajrakanda	Collections (gulma)	—
10.	Kṛṣṇakanda	Kṛṣṇakanda	Kṛṣṇakanda	Kṛṣṇakanda	Kṛṣṇakanda	Creepers	—
11.	Sūranakanda	Sūranakanda	Sūranakanda	Sūranakanda	Sūranakanda	Grasses	—
12.	Khullada	Khullada	—	Khullada	Khullada	Knots	Knots
13.	Hirili	Hirili	Hirili	—	—	Leaves	—
14.	Sirlī	Sirlī	Sirlī	—	—	Śaivāla (moss)	—

1	2	3	4	5	6	7
15. Sir-sirli	Sir-sirli	Sir̥-sirli	—	—	Pānaka (Aq. Plant)	—
16. Chiria	Kṣīrikā	—	—	—	Kavaka (Mushroom)	—
17. Kṣīravidālikā	Kṣīravidālikā	—	Kṣīravidālī	—	Kuhn (Fun-gus, molds)	—
18. Moṭha	Moṭha	—	Moṭha	Green Moṭha	Kinva (enzymes)	—
19. Rihini	—	—	—	—	—	Avaka
20. Thīruga	—	—	—	—	—	Arabi
21. Huthihu	—	—	—	—	—	Ratālū
22. Sihandi	—	—	—	—	—	Flowers (mustard)
23. Mudgaparṇī	—	—	Mudgaparṇī	—	—	Candiraka
24. —	Kṛmirāśi	—	Kṛmirāśi	—	—	Jamīkanda
25. —	Lohī	Lohī	Lohinī	—	—	Udumbaras
26. —	Snuhī-thuer	Snuhī	Snuhī-flower	—	—	Gvārapāṭhā
27. —	Stibhū	—	—	—	—	Gr. Vegetables
28. —	—	Garlic	—	Garlic	—	—
29. —	—	Onion	—	Onion	—	—
30. —	—	Kandalīkanda	—	—	—	

1	2	3	4	5	6	7
31. —	—	Kandalī	—	—	—	—
32. —	—	Kustuvaka	—	—	—	—
33. —	—	Javaikanda	—	—	—	—
34. —	—	Kuhaka	—	—	—	—
35. —	—	—	Avaka	—	—	—
36. —	—	—	Panaka	—	—	—
37. —	—	—	Śaivāla (moss)	—	—	—
38. —	—	—	Mihuttu	—	—	—
39. —	—	—	Hastabhaga	—	—	—
40. —	—	—	Śituṇḍī	—	—	—
41. —	—	—	Ruru	—	—	—
42. —	—	—	Kandurika	—	—	—
43. —	—	—	Jaru	—	—	—
44. —	—	—	Kambu	—	—	—
45. —	—	—	Karnot-kata	—	—	—
46. —	—	—	Madhuka	—	—	—
47. —	—	—	Balaki	—	—	—
48. —	—	—	Madhśringi	—	—	—
49. —	—	—	Niruha	—	—	—
50. —	—	—	Sarpa-sugandha	—	—	—

1	2	3	4	5	6	7
51. —	—	—	Chinnauruha	—	—	—
52. —	—	—	Vijruh	—	—	—
53. —	—	—	Padha	—	—	—
54. —	—	—	Mṛgavaluṅkī	—	—	—
55. —	—	—	Madhura-rasa	—	—	—
56. —	—	—	Rajapatri	—	—	—
57. —	—	—	Padma	—	—	—
58. —	—	—	Matharī	—	—	—
59. —	—	—	Dantī	—	—	—
60. —	—	—	Chandī	—	—	—
61. —	—	—	Kitti	—	—	—
62. —	—	—	Māṣapaṃī	—	—	—
63. —	—	—	Jīvita	—	—	—
64. —	—	—	Reṇuka	—	—	—
65. —	—	—	Kākolī	—	—	—
66. —	—	—	Kṣīrakākolī	—	—	—
67. —	—	—	Bhṛṁgī	—	—	—
68. —	—	—	Nakhī	—	—	—
69. —	—	—	Haṅgalakī	—	—	—
70. —	—	—	Palluka	—	—	—

1	2	3	4	5	6	7
71. —	—	—	Kṛṣṇaprakula	—	—	—
72. —	—	—	Hada	—	—	—
73. —	—	—	Hartanuka	—	—	—
74. —	—	—	Loyanī	—	—	—
75. —	—	—	Grass roots	—	—	—
76. —	—	—	Bulb roots	—	—	—
77. —	—	—	Bambooroots	—	—	—
78. —	—	—	Śrigataka Cluster	—	—	—
79. —	—	—	Rasabheda	—	—	—
80. —	—	—	—	Girikarṇikā	—	—
81. —	—	—	—	Śatāvarī Vela	—	—
82. —	—	—	—	Āmṛta Vela	—	—
83. —	—	—	—	Suar valli	—	—
84. —	—	—	—	Theg Vegetable	—	—
85. —	—	—	—	Pallanka Veg.	—	—
86. —	—	—	—	Bathua Veg.	—	—
87. —	—	—	—	Lūnī Veg.	—	—
88. —	—	—	—	Gulencha	—	—
89. —	—	—	—	Vanśakarelī	—	—

1	2	3	4	5	6	7
90. —	—	—	—	Carrots	—	—
91. —	—	—	—	Kunvara	—	—
92. —	—	—	—	Mushrooms	—	—
93. —	—	—	—	Leaf buds	—	—
94. —	—	—	—	Raw tamarind	—	—
95. —	—	—	—	Kharsanī	—	—
96. —	—	—	—	Thora	—	—
97. —	—	—	—	Billai	—	—
98. —	—	—	—	Green Kachuro	—	—
99. —	—	—	—	Sprouts, Pulses	—	—
100.—	—	—	—	Bulbous roots	—	—

Table 3 A : Number of General Plants in Texts.

1.	*Bhagavatī*	23
2.	*Jīvābhigama*	22
3.	*U T A*	22 (Some Differ)
4.	*Prajñāpanā*	63
5.	*Jīva-vicāra-prakaraṇa*	32
6.	*Mūlācāra*	18
7.	*Lati Saṁhitā*	14

rofers to the development from unicellular to multi-cellular stage in current terms. This is known by the fact that the body of such a plant is about 10^{-15} cm in the beginning. Bigger the plants, larger will be the size and number of cells or lives in them with similar capacities. As multi-cellular life develops, every plant will contain a number of dormant life species in proportion to its body.

Table 2 suggests that individual plants should have clear veins, joints and knots. They should be unequally divisible and threads should be seen there. It should not grow when cut and its barks should be thicker. In contrast to other canons, *Dhavalā* and *Gommaṭasāra* have defined the supporting individual plants in a similar way as the fine and gross general plants[28]. This creates a confusion about the distinction between the two which could be avoided by assuming the statements as reflecting the formalisation of substrate in the substratum as individual bodied plants support the life of parasitic general plants.

The Jaina scholars had a keen observation power and they could identify the various plants in this category available in their period. Digambara pro-canons generally do not contain specific lists of individual plants. However, *Gommaṭasāra* (*Jīva-kāṇḍa*)[29] mentions their five classes : grasses, tendrils, bulbous roots, small and big trees. In contrast, *Prajñāpanā*[30] and other texts classify them in 12 phylums with many species under each phylum. The twelve phylums are given in Table 4. Out of these, the trees are further sub-classified in two varieties : (i) those yielding single seeded fruits and (ii) those yielding multi-seeded fruits. All the twelve categories have a total of 339 plants which when added to the fore-told general plants make the total species of plants well above 450. The details of individual bodied plants are given in Table 4. There might appear some duplication but it may be unavoidable. However, it is clear that this classification is not utilitarian and represents some other similarities — specially macroscopic shape. It is said that

Table 4 : Classification of Individual Bodied Plants.

No.	Class	Botanical Category	Number	Names
	1	2	3	4
1.	Agaricus (*Kuhana*)	Cryptogam	10	Aya, kaya, kuhana, kunaka, sapha, Dravyahallika, sajja, chatrauka, vanśinakhita, kuraya.
2.	Water-growing plants (*Jalaruha*)	Cryptogam/ phanerogams	28	Udaka, avaka, panaka, shevala, hadha, kalambuka, kasheruka, kacchha, bhani, utpala, padma, kumuda, nalina, subhaga, saugandhika, puṇḍarīka, mahāpuṇḍarika, śatapatra, sahasrapatra, kalhara, kokanada, aravinda, tamarasa, viṣa-mṛṇāla, puṣkara, sthalaja puṣkara, viṣa.
3.	Grasses (*tṛṇa*)	Monocots	21	Settika, bhantiya, hotrika, kuśa, darbha, podaila, arjuna, āṣāḍhaka, rohitāmśa, bhūsa, castorplant, kuruvinda, karkara, bibhaṅga, madhuratṛṇa, kṣuraka, parvaka, śukaveda, kṣiratuṣa, śuṇṭha, śuktika.
4.	Circular Bark trees (*Balaya*)	Monocots	17	Tāda, tamāla, takkali, jotli, sali, sālkalalyana, sarala, jatipatra, ketki, kadalī, charmavrikṣa, bhojapatra, asafoetida, clove tree, bettlenut, palm/date tree, coconut tree.
5.	Knotty plants (*parvaka*)	Monocots	22	Sugarcane, Ikṣuvatika, virana, ikkada, bhamasa, sara, vetra, timira, śataparva, nala, bamboo, venu, kanaka, karkavamśa, charyavamśa, kutaka, vimaka, kandaveṇu, kalyanaka, udaka, śuṇṭha, vella.

1	2	3	4
6. Trees-one seeded (*vṛkṣa*)	mono/dicot	32	Neem, mango, jambolans, jangalī mango, teak-wood, ankola, pilu, selu, sallaki, mochaki, black tulasī, bakula, palāśa, karañja, putrañjīva, soap-berry, baheḍā, harītaka, bhallātaka, dhātakī, umbebharikā, priyāla, śimśpā, khimī, plakṣa, aśana, punnāga, nāgavrikṣa, śrīparṇī, aśoka, pūtika, naktamāla.
7. Trees-multi-seeded	Dicots	33	Agasthika, tinduka, kapittha, āmrātaka, mātuliṅga, vilva, āmalaka, phanasa, pomegrenate, pippala, umbara, baṭa, banyan, nandī, pippalī, śatari, plakṣa, kakodumbarī, devadāli, tilaka, mustard, śataparṇa, dadhiparṇa, dhava, sandalwood, arjuna, kadamba, kuṭaja, nipa, kustumbari, lakuca, chatraugha, lodhra.
8. Harvesting plants (Oṣadhi)	Mono/Dicots	26	Śāli, brīhi, wheat, barley, urada, masura, tila, mūṅga, māṣa, niṣpāva, kulattha, ali-sandaka, satin, palimath, linseed, kusumbha, kodrava, kaṅgu, ralaka, varśyamaka, koddaśa, hemp, mustard, radish seed, varatta, Java-Java.
9. Clusters (gucchā)	Dicots	53	Briñjala, sallakī, thunḍakī, kacchurī, rūpinī, jasumana, āḍhakī, nili, tulasī, mātuliṅga, kustumbharikā, loṅg, pepper, alasī, kakamāci, paṭolā, kandalī, vuchu, vikurva, bathuā, berries, patrapura, śitapuraka, javāsaka, nirguṇḍī, arka, tuavari, attaki, talaputta, hemp, pāna, kāsamadraka, āghrātaka, śyāma (priyaṅgu), sidmarda, karmards, aḍūsā, karīra, airavana, mahiṭṭha, jaulaga, malaga, parili,

1	2	3	4
			gajamarini, kuracakrikā, bhandi, jāvaki, ketaki, ganja, patla, dāsī, ankolla, vilvi.
10. Flower plants (gulmas, shrubs/ bushes)	dicots	25	Seritaka, jasmine, korantaka, bandhujīvaka, mogra shrub, pitika, pāna, kanera, kubjaka, sinduvara, jāti, moghrā, jūhī, mallikā, vasantī, campaka, vastula, kastula, śevala, mrigadantikā, granthī, navanitika, kunda, mahājāti, jiti.
11. Green vegetables (*Harita*)	Dicots	28	Ajaruha, vodana, harītakī, bathuā, taṇḍuleyaka, marjaraka, pallaka, vilvi, pāti, dakpippali, cabbage, svastika, brāhmī, radish, mustard, āmlā, sāketa, jīvaśāka, tulasī, black tulasī, faneyaka, coraka, bhuj-naka, āryaka, damanaka, maruchaka, śatapuṣpī, indivara, poraka.
12. Creepers (*Valli*)	Dicots	45	Puṣpaphali, kaliṅgī, gourd, cucumber, ghośātakī, paṇḍola, nili, kaṅgulatā, karkotaki, kāravellaki, subhaga, kuvadha, vaguli, pāpa-valli, devadali, anantamūla, atimukta-latā, betel-leaf creeper, jaṭā-māmsī, sunflower creeper, saṅghaṭṭa, sumanasa, jasumana, kuvindavalli, āmlā, mridvīkā, ambavalli, kṣīravidālī, jīvantī, govali, pani, māśavalli, gañjavalli, vatthani, girikaṃikā, māluki, ajjanikā, dadhi-kāmuka, kākalī, moghra creeper, arkabondi, kandakika, bhalli, gopali, śaśavindu, sasivi.
13. Climbers (*Latā*)	Dicots	10	Padmalatā, Nāgalatā, Aśokalatā, Campakalatā, Mango creeper, Vanalatā, Mogara/vasantī latā, madhavi creeper, kundalatā, śyāmalatā.

the roots, bulbs, stem, bark, branches, new leaves and flowers are general bodied while leaves and fruits are individual bodied.

Botanical Classification : **Non-flowering & Flowering Plants**[31]

Modern botany clsssifies the plants in two basic categories of : (i) chryptogams (non-flowering and non-seeding) and (ii) phanerogams (flowering and seeding) with many subclasses under each class shown as under :

Table 5 : Botanical Classification.[32,33]

(1) Non-flowering plants		(2) Flowering plants	
(a) Thallophyta	Algae, fungii, bacteria, lichen	(a) Gymnosperms	conifers
(b) Bryophyta	Mosses, liver-wort	(b) Angiosperms	
		(i) Monocots	mostly cereals
(c) Pteridophyta	ferns	(ii) Dicots	fruity/other plants.

The sub-classification of these basic categories have been undergoing many additions from time to time so that the number of phylums have increased. It has led to more specificity and fineness in sub-classifications. The non-flowering plants include various varieties of algae, fungii, bacteria, moss, ferns, etc. which are the various stages of lowly developing primitive plants. They may be unicellular and not highly multicellular and generally non-specific. *Prajñāpanā* and *Mūlācāra* include these varieties in their general bodied plants, but they also involve higher plants to a larger extent which are flowering too specially the roots, tubers and bulbous plants.

Botanically, higher plants are flowering plants classified under two groups — monocots and dicots referring to seeds in the kernel. They might be equated with the individual category of the Jainas. But here also, one finds many anomalies as below :

(i) They include grass, algae and fungii etc. under water growing plants category and umbrella type vegetation

under agaricus category. These are mostly non-flowering plants.

(ii) These plants do not include higher plants like bulbs, roots, tubers which are included in general plant category.

(iii) It is only the trees which are classified under one/ multi seeded varieties. However, Table 4 indicates that almost all flowering plants could be single or multi-seeded. Thus, all individual plants should be grouped under these two sub-classes.

(iv) The list of single seeded class of trees contains many dicots. Thus, it seems to be a mixed list.

Thus, we find that despite the basic varieties being the same in canons and botany, their details show sufficient anomalies requiring clarificatory concordance. Under the circumstances, the two-fold classification of the Jainas cannot be equated with the botanical one. Their basis seems to be different altogether. However, inclusion of water growing and agaricus plants under both categories suggest that Jainas have not only taken environmental classification into account but they have also indicated the sexual and a-sexual nature of these species which is botanically correct too.

Modern botany has studied about half a million species of plants by now and approximately 5000 new species are searched out every year. On the canonical basis, they represent only about 20% of the total plant species. Though, it could not be said how many more species could be searched out by the botanists of today with the help of modern devices and equipments, nevertheless, it is doubtful that they could go upto 24 lacs of species in present century. Similar will be the case of the families of plants. It seems that these numbers have been given to indicate the extensiveness of the plant kingdom.

Dhavalā[34] has mentioned a *gāthā* of *Pañca-saṅgraha* indicating that sensations of all types are experienced by the

plants though their sense of touch only. This means that sensations of other senses are also experienced by plants. This fact was not easily explainable until Sir J. C. Bose experimentally verified many sensations experienced by plants. J. B. S. Haldane has gone still further by stating that every plant or its cells possess existence of all five types of sensations. They may be non-existent physically or they may not be fully developed in lower plants. Currently, the botanists are examining various sensations in plants. Sun-flower, *Chuimui* and many other plants are natural examples. Melodious sounds and high sun has definite effects on plants. It therefore seems that botanists have been able to confirm about multiple sensations in plants as mentioned in *Pañca-saṅgraha*. Baxter's[35] experiments are further confirmation to this effect. It is therefore worth thinking whether canons tell us about the physically visible senses only or whether they might reflect upon their psychical senses too.

Other Properties of Plants

As pointed out earlier, Table 1 contains many additional informations about plants in canons in the form of disquisition doors. The plants have normally sub-human destinity but they can have two onward transits. The plants have three bodies, gross, fine luminous and kārmic ones. The gross body may contain upto ten major parts which have been identified. They may have irregular shapes and varying sizes. They have the weakest sixth bone joint system. They have only bodily activity and non-occular vision. They have respirations and intakes of food from all directions. They have indistinct speech (non-speaking). They have 4 vitalities, completions and instincts. They may have dormant mental consciousness. Many more physical informations are available in addition. Besides this, there are some volitional or psychic qualities of plants mentioned. They may have wrong faith and sensory and verbal knowledge. They have attachment and aversion and no restraint. They stand at the first spiritual stage which may be

mutated. They have passions and aural colouration of first three types. They have *kārmic* body bondage with feelings of pain and pleasure. Their life-span is varying between a minimum of 48 mts. to 10,000 yrs. with fine plants to have a very large life span.

Numerically, botanists do agree that the number of fine or general plants is far more than gross plants. Of course, this is also true that fine plants have not been studied in as great a detail as the gross plants.

The respirations in plants have been detailed in *Bhagavatī* which mentions that it could be substantive, all-regional, all-timal and all-statal. However, the word respiration seems to have a wider sense in canons. It represents food in general for plants. Scientifically, it represents generally nasal gaseous intakes (outer skin of plants serves this purpose). This is confirmed in plants today by carbon dioxide cycle occurring continuously where carbon dioxide is intaken and oxygen is released in atmosphere. This cycle is very important for human life.

Canons have pointed out that though there is only the first sense in plants physically, but they may have all the senses psychically. Canonically, they have a-sexual reproduction only while the botanists verify their sexual birth also.

The above summary of botanical contents in canons suggest that they are comparatively not as much as in case of animals and human beings. However, many canons have mentioned names of many trees in kingly gardens and forests to show their large variety. Moreover, it can be surmised that the Jainas had developed many basic concepts about structure and classification of plants much earlier than the botanists. The scientifically verifiable canonical livingness in plants is not only factual but suggests for a non-violent and equalitarian morality among humans. The practice of this concept is one of the major solutions for the environmental problems of the day where not only avoidable destruction of plants has become a sin, but their plantations are being declared as a sacred duty also.

A comparison of canonical and botanical contents of plant kingdom suggests a gulf of difference in many respects. A more vigorous effort is necessary to limelight the detailed canonical contents. Some terminological equivalence will, also, have to be postulated before making exact statements. This requires deeper dive into canons and their commentaries. This may result in some more correspondence and clarifications. However, it can easily be said that current botany has many finer and additional elements over the canonical contents. It is the historical perspective which will help us in proper analysis and discussion about canonical contents.

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Chapter 15

Zoological Contents in Prākṛta Canons

Modern zoology deals with animal kingdom including human beings. They form the second and more important variety of living beings in the middle portion of the Jaina universe. Canonically, there is difference between animals and human beings-representing two separate destinities. There are two specific terms used in canons. The animals and plants belong to the class of transverse movers or non-movers called *'tiryak'* or *'tiryañcas'* having 1-5 senses with or without mind. The human beings, on the other hand, belong to the class of erect or transverse movers called mobiles or *'trasas'* having 2-5 senses with or without mind. Thus, we have,

(i) *Tiryañcas* or transverse moving family	1-5 sensed excluding human beings (and hellish & celestials) : pure and mixed[1]
(ii) *Trasa* or mobile family	2-5 sensed beings including human family (and hellish & celestials).

Generally, current zoology will include all the mobile family of living one, and 2-5 sensed animals of *tiryañca* family. Thus, while canons differentiate between animals and human beings, the zoological sciences do not as they presume evolutionary concept of development for different species. The hellish and celestial are also mobile but they will not be discussed here because of limitations of scientific methods.

Canonically, the mobile beings are defined as those which have slow or fast translocational movements for food and shelter, experience of pain, pleasure, fear etc. and activity towards self-protection from 15 types of pains[2]. They contain a minimum of two senses. They may have mind or brain also. The *karma* theory presumes they are born in this destinity due

to mobile physique-making *karma* irrespective of their movements or organs. They may also be defined on the basis of their birth types. They may be procreating sexually or a-sexually. They have a different mode of growth and they depend on others for their food. They reside in the mobile tunnel of the universe.

As with plants, sufficient physical description is available in canons regarding zoological kingdom with respect to available species, their classification and identification. They have been described under many disquisition doors as shown in Table 1[3]. Only useful informations have been given here under various aspective studies reflecting their wide variety. However, it is seen these are mostly observable points of pre-instrumental age. One does not find many aspective details of current zoology which deal with about twelve branches like anatomy, embryology, cytology (cell study), histology (tissue study), genetics and evolution etc. *Jīvajīvābhigama*[4], *Jīvakāṇḍa* and other procanons describe them under taxonomy, morphology, senses, vitalities, body, libido, evolutionary completions, anatomy and physiology (food, instincts etc.). Many other disquisition doors include psychic, inner or volitional aspects like passion, spiritual stages, colourations, activities, knowledge, applied consciousness, etc. These qualities are subject to mental speculations and experience. Because of the moral emphasis of religion, much stress has been given to these later qualities while others like cytology, genetics etc. are hardly mentioned in canonical literature.

Jaina Taxonomy for Mobile Beings

The mobile beings are classified in many ways which are based on motion, senses, external structural similarity like forms, etc., habitat, birth-types and other factors. This forms a mixed natural-cum-artificial classification (Table 2). Sikadar[5] suggests that Jaina classification is sufficiently advanced over vedic period. The sense-based classification is, however, widely described in canons and procanons. It is observed that there

Table 1 : Description under Disquisition Doors, Mobile Kingdom*.

No.	Disquisition Doors	2-sensed	3-sensed	4-sensed	5-sensed animals	5-sensed humans
	1	2	3	4	5	6
1.	Naming	Mobiles Oblique Moving	Mobiles	Mobiles	Mobiles	Human
2.	Numeration	39	55	45	3 (2)	2 (10, 3)
3.	Accomodation/Size (Min.)	$1/A_sA$	$1/A_sA$	$1/A_sA$	$1/A_sA$	$1/A_sA$
4.	Acco./Size (Maximum)	12 Y	3 Kośa	4 Kośa	2-9 K-1000 Y	3 Kośa
5.	Fineness	Gross	Gross	Gross	Gross	Gross
6.	Life-span (Minimum)	48 minutes	48 minutes	48 minutes	48 minutes	48 minutes
7.	Life-span (Maximum)	12 years	49 days	6 months	72,000 years 84,000 years 3 Palyas (p)	3 P
8.	Body types	3	3	3	3/4	5
9.	Modifications	Infinite	Infinite	Infinite	Infinite	Infinite
10.	Shapes	Irregular	Irregular	Irregular	Irregular	6
11.	Bone Joints	6 th	6 th	6 th	6 th	6
12.	Sex	Neuter	Neuter	Neuter	Neuter, 3	3
13.	Intake (Food etc.)	←	—	6 Directions	—	→

1	2	3	4	5	6
14. Intake (Types)	3	3	3	3	3
15. Respiration	Yes	Yes	Yes	Yes	Yes
16. Colours	5	5	5	5	5
17. Instincts	4	4	4	4	4, 10
18. Speech	← Non-verbal →			Verbal, Non-verbal	
19. Completions	5	5	5	5, 6	5, 6
20. Vitalities	5	6	7	9	10
21. Birth	S	S	S	U, S	U, S
22. Birth place	← Open, all Climates, Temperatures →			Mixed	Mixed
23. Birth-place (Number)	2 lacs	2 lacs	2 lacs	4 lacs	14 lacs
24. Families	7×10^{12}	8×10^{12}	9×10^{12}	$43.5/53.5 \times 10^{12}$	$14/12 \times 10^{12}$
25. Extrications	Last 3	Last 3	Last 3	3, 5	7
26. Destinity	4	4	4	4	4, 5#
27. Ownership	Self	Self	Self	Self	Self
28. Mind	—	—	—	Yes/No	Yes
29. Conation	← Non-occular →			2, 3	4
30. Colourations	First 3	First 3	First 3	4, 6	6, 7#
31. Passions	4	4	4	4	4, 5#
32. Activity	2	2	2	2, 3	3, 4#

1	2	3	4	5	6
33. Applied Consciousness	2	2	2	2	2
34. Feelings (Pain etc.)	Physical	Physical	Physical	3	3
35. Kārmic Bondage	7-8	7-8	7-8	7-8	7-8
36. Attachment	Yes	Yes	Yes	Yes	Yes
37. Restraint, R	Non-R	Non-R	Non-R	R-cum-non-R	R, NR
38. Spiritual Stages	5	5	5	5	14
39. Liberatability	← Yes, Through human destinity →				Yes
40. Knowledge	← First Two →			2, 3	5
41. Faith	← Right/Reverse →				
42. Feeling Bonding	3	3	3	3	7-8
43. Form	Visible	Visible	Visible	Visible	Visible
44. Senses	2	3	4	5, 6	5, 6#
45. Spatial location	Part of Upper,	Middle,	Lower,	Universe,	22 Watery places.

* Data Collected from *Karmagrantha, Prajñāpanā, Jīvajīvābhigama, J. S. K.* etc.
Y = *Yojana;* K = *Kośa,* N = Neuter; S = A-sexual. (*Sammurchima*), # = *Ṣatkhaṇḍāgama.*

Table 2 : Canonical Classification of Mobile beings.

1	2	3
[A] *Two Classes of Five Types*		
1. *Sūtrakṛtāṅga*-1	Completion based	Completioned, Non-completioned.
2. *Sūtrakṛtāṅga*-1	Birth Based	Sexual, A-sexual.
3. *Mūlācāra*	Sense Based	Deficient-sensed, All-sensed.
4. T. S. bhāṣya	Motion Based	Physical motioned, Psychical motioned
5. Tattvārtha Vārttika	Mind Based	With mind, Without mind
[B] *Three Classes of Mobile Beings*		
1. *Daśavaikālika*		
2. *Uttarādhyayana*	Form/Motion	Air bodied, Fire bodied, gross bodied
3. *Jīvajīvābhigama*		
[C] *Four Classes of Two Types*		
1. *Jīvajīvābhigama*	Sense Based	2, 3, 4, 5-sensed
2. *Gommaṭasāra Jīvakāṇḍa*	Completions	General, completioned males and females, non-completioned.
[D] *Eight Classes of Mobile Beings*		
1. *Ācārāṅga*	Origin/Birth	Incubatory, umbilical, non-umbilical, sweat-born, fluid-born, sprouting, A-sexual, special bed (hellish & celestials)
2. *Daśavaikālika*		

1	2	3
[E] *Fifteen Classes of Mobiles*		
1. *Gommaṭasāra Jīvakāṇḍa*	Completions	Completioned, structural and timal non-completioned (2, 3, 4-sensed, 5-sensed rational, 5-sensed non-rational)-5 X 3
[F] *Ten Classes of Mobile Beings*		
1. *Triloka Prajñapti*-2	Sense/Completion	Completioned, Non-completioned (2, 3, 4 sensed) + 5-sensed with/without mind and completioned & non-completioned
[G] *Thirty Classes of Mobiles*		
1. *Gommaṭasāra Jīvakāṇḍa*	Senses, Completions, birth	15 as in (E) X (Uterine + A-sexual)
[H] *Forty-eight classes*		
1. *Gommaṭasāra Jīvakāṇḍa*	Sense/Completions/ birth	(2, 3, 4 sensed) X 3 types of completions as in E = 9, Uterine animals action land = 18, A-sexual animals action land = 12, Enjoyment land animals = 4, Aryan human beings = 3, Non-Aryan humans = 2.
[I] *Two Classes of Current Zoology*		
Inner/outer structure		(i) Invertebrate and (ii) Vertebrate
Embryology		
Evolutionary stage		2. Protozoa, Metazoa

is structural difference between 2-4 sensed and most five-sensed beings. The later are generally vertebrates while the earlier ones are invertebrates. Thus, despite no mention about it in canons, this has seeds of modern zoological taxonomy. Table 2 gives different types of classifications of mobiles in canons based on many factors. It is seen that the classes are not as numerous as the living beings in general. The mobile classes vary between 2 and 48. However, it is observed that sense-based classes have been further subclassified according to different available species as shown in Table 3 onwards. It is clear that this canonical classification is neither binomial nor international as the names are in Samskṛta or local language. However, this should not be taken as a defect, as these concepts are post-eighteenth century developments.

Table 3 : Sense-based Sub-classification of Mobile Beings.[6]

Source	2-sensed	3-sensed	4-sensed	5-sensed Tiryañcas	5-sensed Humans
1. *Uttarādhyayana*	14	16	26	3	2
2. *Prajñāpanā*	29	41	38	3 (2)	2 (10, 3)
3. *Jīvajīvābhigama*	29	41	38	2 (3)	2 (10,3)
4. *Pañca-saṅgraha*	7	8	9	8	-
5. *Jīva-Vicāra-Prakaraṇa*	11	18	10	3	3
6. *Ṣaṭ-khaṇḍāgama*/TP	-	-	-	-	2

It is seen from Table 3 that there is difference in mobile sub-classes in different texts either partially or wholly. However, *Prajñāpanā* gives the largest number of species in every sub-class with *Jīvajīvābhigama* nearly following it. The Digambara procanons lag behind in the classes of 2-4 sensed mobiles

and five sensed animals exept for representative examples. Of course, T. S. and later commentaries give some details about human classification[7].

Table 4, 5, 6 give names of 2, 3, 4-sensed beings in a consolidated way. There are about 40 2-sensed, 55 3-sensed and 50 4-sensed mobiles listed in canons. However, about 25% names are familiar today in current terms, others have to be identified. All these animals are deficient sensed and form invertebrate class of zoology. There seems to be some duplication in names (like scorpion, spider, red water insects etc.) suggestive of either different varieties of them or uncertainty about their senses.

Table 4 : Two-sensed Beings in Jaina Canons.

1. Intestinal worms	2. Tape worms
3. Thread worms	4. Cowdung/Cowhair worms
5. Needle mouthed worms	6. Flute mouthed worms
7. Deadbody worms	8. Snakelike worms
9. Timber worms	10. Saliva insects
11. Red water insects	12. White ants
13. Sea louse	14. Conch
15. Small conch	16. *Śambūka* conch
17. *Ghulla* conch	18. *Khulla* conch
19. Pearls	20. Mother pearls
21. Śukti	22. Cowrie
23. Small cowrie	24. *Dvidhāvarta*
25. *Nandyayavarta*	26. *Ekatāvarta*
27. Leech	28. *Saumaṅgalaka*
29. *Gojalaka*	30. *Jalomuka*
31. *Nūpura*	32. Jaggery germs
33. *Kalukavas*	34. *Anullaka*
35. Candanaka (spl. cowrie)	36. *Skandha*
37. *Śuktisampuṭa*	38. *Palloya*
39. *Ariṣṭa* etc.	

Table 5 : Three Sensed Beings in Jaina Canons.

1. *Kunthu* insects	2. Bugs
3. Black ants	4. Red water insects
5. Centipedes	6. Louse
7. Motha	8. Grass-eater insects
9. Wood-eater insects	10. Leaf-eater insects
11. Cotton insects	12. Cucumber insects
13. *Maluka*	14. *Tṛṇa-vṛntaka*
15. *Patra vṛntaka*	16. *Phala vṛntaka*
17. Flower *vṛntaka*	18. *Tenduran majjika*
19. *Hillika*	20. *Jhillika*
21. *Jhiṅgura* (cockroach)	22. *Kingrita*
23. *Bāhuka*	24. *Laghuka*
25. *Subhaga*	26. *Sauvastika*
27. *Śukavṛnta*	28. *Indrakāyika*
29. *Turutumbaka*	30. *Kuṣthulavalaka*
31. *Ralahala*	32. *Piśuka* (flea)
33. *Śaṭapadika*	34. *Hasti-śuṇḍa*
35. *Aupāyika*	36. *Rohiṇika*
37. *Utkalika*	38. *Utkaṭa*
39. *Indragopa*	40. Ass-shaped insect (*Uttinga*)
41. Nṛtyika (dancing insect)	42. *Illika* (grain insect)
43. *Ghṛta-illika* (butter insect)	44. *Savaya* (crab louse)
45. *Go-kiṭa* (cow-ear insect)	46. Gardabhaka (faecal/dungal germs)
47. Dhanyakīṭa (paddy insects)	48. Gopālaka illika (rice insects)
49. Spider	50. Scorpion
51. *Tinduka*	52. *Uddansana*
53. *Vīja vṛntika*	54. *Śatāvarī*
55. Centipedes, different types	

Table 6 : Four Sensed Beings in Jaina Canons.

1. Scorpion	2. Cattle bug
3. Spider	4. Drone
5. Flies	6. Mosquitoes

7. She-bees	8. Locusts
9. Honey bees	10. Knats/gadfly
11. Butterfly	12. Grasshopper
13. *Andhika*	14. *Pattiya*
15. Cattle bug	16. *Kukkuda*
17. *Kukkuha*	18. *Nandāvarta*
19. Śiṅgirada	20. *Kṛṣṇa-patra*
21. *Lohita Patra*	22. *Nīla Patra*
23. *Haridrāpatra*	24. *Śuklapatra*
25. *Citrapakṣa*	26. *Vicitrapakṣa*
27. *Ohañjalika*	28. *Jalacarika*
29. *Gambhīra*	30. *Nonika*
31. *Akṣiroda*	32. *Akṣivedha*
33. *Sāraṅga* (black bee)	34. *Nevāra*
35. *Dola*	36. *Bharili*
37. *Jarula*	38. *Totta*
39. *Patra-vṛścika*	40. *Chana-vṛṣcika* (cow-dung scorpion)
41. *Jala-vṛścika*	42. *Priyaṅgala*
43. *Kanaka*	44. *Gomaya kīṭa* (faecal insects)
45. *Tantavaka*	46. *Māgadha*
47. *Nicaka*	48. *Moṭha* (*Dāmsa*)
49. *Akṣila*	50. *Jalakārī*
51. *Piśuka* (Flea)	

Table 7 gives details of 5-sensed animals where also *Prajñāpanā* and *Jīvajīvābhigama* hold the sway. There are 177 types of animals sub-classified under various heads. They form the vartebrate class of zoology. All these animals are all-sensed mobiles with mind.

Table 7 : Five-sensed *Tiryañcas* (animals) in Jaina canons based on *Jīvajīvābhigama* and *Prajñāpanā*.

5-sensed animals

(i) A-sexual (ii) Sexual

(ii) Sexual

(i) Water moving		(ii) Land moving		(iii) sky moving	
(a) Fish	23	(a) 4-footed		(a) Skinwinged	8
(b) Tortoise	2	(i) 1-hoofed	8	(b) Bristle W	38
(c) Grāha	5	(ii) 2-hoofed	16	(c) Vitata	—
(d) Crocodiles	5	(iii) Gandipada	5	(d) Samudga	—
(e) Śiśumāra	1	(iv) Nailed footed	13		
	36		42		46
		(b) Creepers			
		(i) Arms moving	14		
		(ii) Breast moving	39		
		Total =	53		
Grand Total		36 + 95 + 46 = 177			

Table 8 gives details about 5-sensed human beings for which some description is found in Digambara canons which have been marked by '*' in the Table. They belong to the chordata class of zoology. However, there seems to be difference between human classification among the two versions of the Jainas. *Ṣaṭkhaṇḍāgama* has two different varieties : pure and mixed human beings based on spiritual stages[8]. In contrast, Kundakunda has two varieties — born in land of action and enjoyment[9]. *Bhagavatī Ārādhanā* commentator[10] mentions four varieties — two of Kundakunda and (iii) born in inner islands and (iv) a-sexuals. These seem to be akin to *Prajñāpanā*. There is no mention of Aryan and non-Aryan varieties in these texts. But *Prajñāpanā*[11] and *Jīvajīvābhigama* start the classification of human beings into Aryan and non-Aryans at the third stage while T. S.[12] starts the same at the first stage. Moreover, there is also difference in the sub-classification of Aryans and non-Aryans as below :

Table 8 : Five Sensed Human Beings in Jaina Canons.

Human Beings

(I) A-sexual* 10 — (II) Sexual

(I) A-sexual* 10	(i) Inner islanders 28 Born in	(ii) Action landers 15 Born in	(iii) Non-action landers 30 Born in
(i) Faeces	1. Ekoruka	Bharata regions 5	Hemvata regions 5
(ii) Urine	2. Abhasika	Airāvat regions 5	Hari regions 5
(iii) Cough	3. Vaiśanika	Mahāvideha regions 5	Ramyak regions 5
(iv) Mucus	4. Narigilika		Devakuru regions 5
(v) Vomitting	5. Hay-karṇa		Uttarakuru 5
(vi) Bile	6. Gokarṇa		Hairaṇyavat 5
(vii) Pus	7. Śaskulī K.		
(Viii) Blood	8. Gajakarṇa		
(ix) Semen	9. Ādarśamukha		
(x) Seminal fluid	10. Ayomukha		
	11. Gomukha		
	12. Mendhmukha		
	13. Aśvamukha		
	14. Hastimukha		
	15. Simhamukha		
	16. Vyāghramukha		
	17. Aśvakarṇa		
	18. Harikarṇa		
	19. Ākarṇa		
	20. Karṇapravarṇa		
	21. Ulkāmukha		
	22. Meghamukha		
	23. Vidyunmukha		
	24. Vidyuddanta		
	25. Ghanadanta		
	26. Laśṭadanta		
	27. Gudhadanta		

* PRJN mentions dead body, Copulation, Village/town sewers in addition.

28. Śuddhadanta

Aryans — Non-Aryans 56

(i) Prodigied 6 (S), 8 (Dig*)		(ii) Non-prodigied 9 (S), 5 (Dig*)		Non-Aryans 56
1. Enlightened		1. Born in regions*	25.5	1. Shakas
2. Univ. monarchs		2. Born in castes*	6	2. Yavanas
3. Baldevas		3. Born in families	6	3. Pulinda
4. Vasudevas		4. Professionals	7, 3*	4. Shabara
5. Vidyadharas		5. Artisans	20	5. Chilata
6. Charaṇas* (kriyā)	2	6. Language speakers	18	6. Goṇḍa
7. Knowledge*	18	7. Knowledge gainers	5	7. Sinhala
8. Transformation*	8	8. Vision gainers*	2, 10*	8. Andhra
9. Austerity*	7	9. Conduct practicers*	2,2	9. Parasy
10. Power*	3		91	10. Vālhīka
11. Medication*	8			11. Kokanaka
12. Desires (Rasa*)	6			12. Lhāsika
13. Regional*	2			13. Khasika
	54			14. Kaikaya
				15. Malayālī
				16. Mālava
				17-56. etc.

GRAND TOTAL :

(i) 6 + 91 + 56 = 153 X (completioned/non-completioned, mind/without mind	=	612
(ii) 30 X 4 (Non-action landers)	=	120
(iii) 28 X 4 (Inner Islanders)	=	112
(iv) A-sexuals	=	10
		854*

(i) The prodigy-based Āryans have been subclassified altogether differently in eight subclasses in comparison to

* For Digambaras, we have (54+46+56+21) x 4 = 708

Adding 10 a-sexuals + 24 inner islanders = 34

742

Prajñāpanā (except *Cāraṇa* and *Vidyādhara* which form part of the movement in different space and non-space mediums),

(ii) The non-prodigied ones have also five classes in comparison to nine of *Prajñāpanā*.

(iii) The non-Āryan sub-classification has two varieties by Akalaṅka — inner islanders and action landers. Though there is no mention of number of inner islanders but the four repre-sentative names there suggest *Prajñāpanā* names. The chara-cteristics of inner islanders are also similar but there are only 21 there in place of 28. However, 24 inner islands have been pointed out and food, residence and age of theirs have been mentioned which is not found in *Prajñāpanā* etc.

(iv) The inner islanders are non-aryans as per Akalanka[12].

(v) There is no mention of human beings in lands of non-action or enjoyment.

(vi) On the basis of human classes being taken with respect to their character of (i) completion and non-completion and (ii) mind or no mind, it can be calculated that the non-Digambara version has 854 varieties of human beings in comparison to 742 varieties of Digambaras assuming non-specified varieties to be equal to non-Digambaras.

(vii) *Kārtikeyānupreksā* has mixed up the above and suggests four types of human beings — Āryans, non-Aryans, action landers and non-action landers. Thus, Digambara canons seem to have a somewhat ambiguous state of human classification[14].

(viii) *Gommaṭasāra Jīvakāṇḍa* classifies humans in nine varieties with respect to their states of completions as below[15]:

(a) Completioned, structural and timal non-completioned humans in Aryan lands		3
(b) Completioned and structural non-completioned in non-Aryan, enjoyment and action lands	2 x 3 =	6
		9

Zoological Classification

(a) Non-chordata Class

Currently, zoology classifies animals and human beings into two broad classes of non-chordata and chordata (or invertebrate and vertebrate). Though this classification stands now modified since 1975, but it suffices us for our comparative discussions here. The non-chordata class does not have notochord in comparison to chordata class. This includes primary protozoic animals, worms and insects generally canonical 2-4 sensed ones (Table 9). It could be divided in nine subclasses. The chordata class has diversified classification but we will include only eight subclasses under this head as shown in Table 9. This includes generally 5-sensed canonical class of animals and human beings.

Table 9 : Zoological Classification of Animal Kingdom.[16]

A. Non-chordata Class		B. Chordata Class	
1. Protozoa	Ameoba	1. Cyclostomata	Jawless fish
2. Coelentrata	Hydra	2. Placodermi	Jawed fish
3. Platihelminthes	Tapeworm	3. Chondrich-thyes	Shark
4. Askihelminthes	Round-worms	4. Oesteichthyes	Rohita fish
5. Mollusca	Snails, conch	5. Amphibia	Frog
6. Annelida	Worms	6. Reptilia	Snake, lizard
7. Arthropoda	Insects	7. Aves	Birds
8. Eschino-dermata	Spiny/soft marine animals	8. Mammalia	Men, bigger animals
9. Porifera	Sycon		

In the non-chordata class, we have protozoan amoeba as the first primitive animal which is unicellular and simplest form of mobile beings[17]. Though it does neither have nervous, nor sensory, nor brain system, but it has sensitivity towards touch, taste, light and other factors. It is invisible and a-sexually

procreated by fission, sporulation, conjugation and regeneration. It is generally water-surface born animal. They are mostly parasitic and have many types-some being pathogenic too. It is said that genetically, amoeba is immortal as it transfers it hereditary characters to its progenies. The second higher category of water-born animals is a visible hydra class (water serpents) which is multicellular. It has at least sensory cells but no brain. It has sexual, a-sexual and regenerative reproduction, i.e., it represents species with start of sex characteristics. These two classes are not found in canons. However, tapeworms, round worms and other worms are found in canons which form different zoological phyla rather than a single two-sensed phylum. Similar is the case of other canonical classes which involve different phyla as shown in Table 10 for some popular animals.

Table 10 : Canonical and Scientific Senses in Some Typical 2-4 sensed Animals.

No.	Name	Kingdom	Canonical senses	Scientific senses	Brain	Sexuality
	1	2	3	4	5	6
1.	Ameoba	Protozoa	—	All Primitive sensations	x	A-sexual
2.	Hydra	Coelentrata	—	4	x	A-sexual
3.	Tapeworm/ worms	Annelida	2	4+1 (pri)	yes	bi-sexual
4.	Conch	Mollusca	2	5	yes	Uni-sex
5.	Pearls	"	2	5	"	"
6.	Cowrie	"	2	5	"	"
7.	Leech	Annelida	2	5	"	"
8.	Jaggery worms	Arthropoda	2	5	"	"

1	2	3	4	5	6
9. Insects	Arthropoda	2	5	yes	Uni-sex
10. Insects, spl.	"	3	5	"	"
11. Ants	"	3	5	"	"
12. Bug	"	3	5	"	"
13. Louse	"	3	5	"	"
14. Cockroach (*Jhingura*)	"	3	5	"	"
15. Illi	"	3	5	"	"
16. Cow-dung Insects	"	3	5	"	"
17. Grass/wood/ leaf-eater/insects	"	3	5	"	"
18. Centipede	"	3	5	"	"
19. Red water Insect	"	3	5	"	"
20. Scorpion	"	3/4	5	"	"
21. Spider	"	3/4	5	"	"
22. Fly	"	4	5	"	"
23. Butterfly	"	4	5	"	"
24. Fleas	"	4	5	"	"
25. Drone	"	4	5	"	"
26. Locusts	"	4	5	"	"
27. Bees	"	4	5	"	"
28. Mosquitoes	"	4	5	"	"

Some observational inferences could be drawn from the table based on discussion with a noted zoologist Dr. Saxena and related literature as below :

(i) The zoological classification is based on gradually developing animal species from water-born to land-born ones. This is partly confirmed from canons also when *Prajñāpanā* points out 22 watery places for location of 2-4 sensed beings[18].

(ii) Almost all the animals (worms, insects) of canonical 2-4 senses have 5 senses, in some case not fully developed

but in most cases specific cells functioning.

(iii) Barring few cases, all animals have brain or mind which makes them even canonically 5-sensed.

(iv) Barring few species, all 2-4-sensed animals are either bi-sexual or uni-sexuals.

(v) Most of the animals are sexually pro-creative.

(vi) The canonical 2-sensed class is zoologically a mixed one in comparison to 3/4 sensed class.

The above points are in direct contrast with canonical descriptions. They have been possible due to internal structural studies during microscopic and electron microscopic age. It seems that criteria of canonical classification must have been visible observable sense rather than microscopically observable organs. It is because of this that the zoological classification is an advance over the canonical one. But what strikes canonically most is that all 2-4 sensed creature-group is as the zoologists group them today and all of them come under non-chordata class not mentioned in canons specifically as stated earlier.

(b) Chordata Class

The chordata class mostly consists of five sensed animals and men. The hearing sense in animals in many cases is internal. It is external too. Their head or brain, and other sensory-organs are developed and they get akin to men. They are canonically classified according to habitat — water moving, land moving and sky moving. The water moving ones can be included in protochordata and 1-4 classes of eu-chordata (i.e. fish, crocodiles etc.). The amphibia is a class of animals which live both — on land and water. Frog is the most common example. This has been and is one of the most common animals for experimental studies. The logicians were using it as a tool for their discussions on many issues. It has been included in the tortoise class. The sky moving birds of all types have been included in the class of aves. The land moving class is included in reptiles and mammals. All these are obliquely

moving and, hence, called *Tiryañcas*. *Prajñāpanā*[19] classifies the water-moving ones in five major classes, the skymoving in four major classes (the last two not found in human region) and landmoving in two major classes as shown in Table 7. Their number of species mentioned in canons seem to be sufficiently limited in comparison to those of zoologists of today. However, there is similarity in both the classifications with respect to gradual developmental base from water to land animals. The human beings are at the top in both the cases. Moreover, as with non-chordata, the canonical classification here too seems to contain some discrepancies such as tortoise and crocodiles are reptiles or arms moving. Rats are mammals rather than reptiles. The birth types mentioned also come in contrast such as rabbit is oviparous rather placental. The zoologists seem to have finer observations which might not have been possible for canonists because of their principles of non-violence. This is a point where this benevolent principle may be held responsible for not obtaining finer knowledge about the living substances.

According to zoologists, men and apes form the primate order of the same subclass of their mammals while canonically men form a separate class by themselves. This is one more difference between canons and zoologists. But this point may be overlooked as man has a special position in whole of the animal kingdom in that (a) it is the highest developed species, (b) it has a languagical speech and ingenious brain and (c) it is subject to religious performance and salvation. There is no mention of apes and chimpanzees in canons which are akin to men in many respects. Per chance, they were not found in India in canonical days. This and other facts suggest that Jaina seers have classified the animal kingdom according to what was observable in canonical times. They held an idea that the world is full of smaller living beings but they have been taken to be 1-sensed under plant kingdom while they are now *proved to be at least two sensed beings like protozoa, amoeba.*

Secondly, it has been proved that taste and smell senses are co-occuring, hence these beings should be at least 3-sensed. These beings had a period when biologists were doubtful about their place. It is very late that they could find place in animal kingdom.

Zoology does not classify human beings as the Jaina canons do. Table 8 suggests that they are classified in two ways according to their birth types — a-sexual and sexual. Canons exemplify a-sexuals born in ten places like pus, dead body, filthy places and the like. They are very small in size. Their maximum life time is 48 minutes. This is subject to verification. It is now known that they may be 2-3 sensed canonically rather than five-sensed. Though the term innumerable is not clearly definable, the biologists estimate their sizes to be varying between 10^{-4}-10^{-5}cm. Of course, zoologically they may be five sensed ones of invertebrate class and not of human family. The postulate about their being human seems to be cause-effect formalisation.

The sexual human beings have been classified on the basis of their residences and qualities as shown in Table 8 about which discussions have already been done. It is shown that Aryans live in 25½ regions or countries while non-aryans live in 56 regions. Accordingly, a good part of India seems to be non-aryan. This description seems to be more important for the geography of those days. This residence-wise classification does not seem to contain any zoological basis as no basic difference between the men of different places could be traced. But this classification also suggests about its external and visual character. And it seems to be getting much behind zoological times.

Other Properties about the Mobiles

As pointed out earlier, table1 contains many additional descriptions about the mobiles found in canons in the form of investigation points. At the inception of their worldly life, they

may have any of the four destinities or transit points — hellish, celestials, sub-human and human. Though the scientists deal with the present, still they are working to look into the problem of transit itself and nothing definite could be said on this point as yet. Of course, the destinities of humans and animals are realities in the world. These have been described both — physi-cally and psychically in canons. The transits, some say, are more of a psychological nature than real so that beings may follow right path while living in the world.

The mobile beings have 3-5 types of bodies — some gross and some fine. Their gross bodies contain eight major parts in five-sensed beings : 2 arms, 2 legs, buttock, back, chest and head. These parts could have many sub-parts-32 pointed out in *Ācārāṅga*[20] and mini-parts. These bodies have different shapes and sizes. They have bones and bone joints. The gross bodies have many layers. These are subject to vanish while fine bodies continue in the coming generations.

There are five types of mobiles with respect to senses as already said — 2,3,4 sensed, 5-sensed non-rational, 5-sensed rationals. Out of which the completioned human population has been said to be 8×10^{28}.[19] However, this number seems to be discrepant when one learns the total population of thé completioned and non-completioned humans in the world is a fractional multiple of Jagaśreṇī whose value is roughly 10^{20}-10^{21} as per calculations of Jain[22] and Munishri[23]. How 10^{28} could be substracted from this number to calculate the population of non-completioned humans ? Thus, either of these two values should be out of tune and they should be looked into to make them concordant.

There is a further discrepancy in this canonical population when it is compared with the current statistics of about 4.2×10^9 out of which canons point out 3/4 to be women[24] in contrast with overall world average of roughly 51 : 49. Per chance, this statement is with reference to psychical attitudes rather than physical forms. Because of discrepancy in the total

population of human beings, the population of 5-sensed *tiryañcas* and total *tiryañcas* can not be calculated in the absence of numericality of total living beings either in T. P., G. J. or T. S. :

Total Tiryañcas = Total living beings–humans–hellish–celestials

$$? - 10^{?} - 10^{20} - 10^{40} = ?$$

Besides, the total number of families of mobiles has been mentioned to be $79 - 89 \times 10^{12}$ and species to be about 2.4×10^{6}. All these numerical statements require current verification as only about a maximum of 10^{6} species have been studied by zoologists of today.

The sense content of mobiles has been said to be not only physical but psychical also so that even in the absece or loss of, say, ear or eye, the animals have capacity to experience various aensations ascribed to different sense-organs. The sensing capacity of senses has also been reported in terms of distances as shown in Table 11 alongwith their shape and size.

Table 11 : Sensing Capacity of Senses in Living Beings.[25]

No.	Type of Beings	Sensing Capacity of Senses 1	2	3	4	5-R	5-NR
1.	1-sensed	400D	—	—	—	—	—
2.	2-sensed	800D	64D	—	—	—	—
3.	3-sensed	1600D	128D	100D	—	—	—
4.	4-sensed	3200D	256D	200D	2954Y	—	—
5.	5-sensed Non-* rational	16400D	512D	400D	5908Y	—	8000D
6.	5-sensed rational	9Y	9Y	9Y	47263Y	12Y	—
7.	Shapes	Varied	Weed-ing hook	Seasa-mum flower	Masūra grain	Barley Tube	
8.	Size		1.5×10^{-18} for all				

The sense of touch has varied shapes while the sense of taste is flat like small weeding hook, that of smell like flower of seasamum, that of sight (eye) like *masūra* cereal and that of the ear like a barley tube. In the table, the size of the senses have been said to be 10^{17}th (innumerableth) part of a ghanāṅgula (= 0.68 cm.). The length equivalent to Dhanuśa, D is app. 92 cms. and a *yojana,* Y is app. 13.28 km. (8 miles).

These sensing capacities have to be substantiated by modern technics.

The mobiles have developed and underdeveloped sexual characters. The deficient-sensed are said to be neuter while 5-sensed ones have all the genders.

The mobiles have three types of activities — physical, vocal and mental. The vocal activity could be expressed through language with or without letters. The rational mobiles have nine types of languages described in *Jīvakāṇḍa*[26]. However, 2-5 sensed non-rationals have only non-lettered vocal activity. The five-sensed have two types of mind — Physical and Psychical. The physical mind is assumed to be like an eight-petalled flower and locatad at the point of heart. This view reflects nearly all Indian Philosophies. The scientists have to concur upon this fact.

The colourations represent volitional character. They indicate the growing purity of mind. They also have two varieties – physical and psychical. Both colourations vary between 1-6 (from black to white). The deficient-sensed mobiles have the first three or four while the completioned rationals have all the six. These colourations have been confirmed by aural colours under Chirilian Photography[28].

All the mobiles have instincts, natural tendencies or desires for food, sex, possessions or sleep and fear or power. These may be experiencial or knowledgal. *Ācārāṇga* and *Prajñāpanā* tell us about 10-16 experiencial and five knowledgal instincts. The ten varieties include instincts of four passions, tradition and whims besides the four above. The 16 varieties

involve the ten above and feeling for pain, pleasure, sorrow, attachment and aversion and religion. The knowledgal instincts are the five types of knowledges. Thus, out of 21, the deficient-sensed mobiles may have a maximum of 17 (only two knowledges and no religion). The completioned and rational mobiles may have all the instincts. These require the existence of different levels of mind for expressions.

Alternatively, there is a second set of instincts mostly to be found in rational beings — education, activity, instructions, recitation[30].

Table 1 shows that different mobile beings have gradually increasing number of vitalities depending on their senses. They range between 5-10.

The Jaina seers have dealt with the current minimum and maximum life-spans of mobile beings. Though nothing could be said about the minimum life-span of less than 48 minutes, but maximum life-span seems to decrease from 12 years to six months as the senses grow from 2-4. However, the trend is changed drastically in the 5-sensed completioned animlas and human beings. Their maximum life-span increases to 3-*palyas* (pit-based large units)[31]. This requires some positive verification from current scientists. However, it seems there is not very much work on life-spans of mobile species in biological sciences. The sizes of mobiles have also a minimum and maximum. The minimum seems to be too small to be measurable – about 10^{-16} to 10^{-18} cm., the maximum also varies between 10 km. to 13000 km (in case of water moving 5-sensed mobiles)[32]. The maximum size of men is said to be 10 km. The body height of the first Tīrthaṅkara — Lord Ṛṣbhadeva is said to be 500D (equivalent to 2.80 km.) which seems sufficiently less in comparison to the above maximum. However, the possibility of such maximum heights of mobile beings is worth investigative verification. Exceptional examples of fossil age animals do not lend high support to such heights.

The birth and birth-places have also been described in canons. They have been mentioned before. There are 2.4 million species of mobile beings under sexual and a-sexual birth. The canons describe three types of shapes of the vagina while the scientists would tell us five types of shapes in the form of : (i) single meridian (flat), duplex (rats), bipartite (frog), bi-cornuate (cat, horse) and (v) simplex (human)[33].

Besides the above physical aspects, many psychical aspects have also been mentioned in canons. Passions, colourations, faith, vision, attachment, restraint, liberatability, kārmic bonding, spiritual stages, applied consciousness and many others have been described qualitatively for mobile beings under different levels. These aspects have sufficient details as their qualitative control induces the living beings to move on a path of salvation which is the main aim of religion. Comparing these details with plant kingdom, it would be observed that animal kingdom has higher capacities, activities and volitional possibilities.

A summary of canonical and zoological contents regarding the mobile beings is given in Table 12 which shows the comparative current position. It shows a gulf of difference in many respects. The quantitative aspects are also differing by a factor of 10^{10}.

Table 12 : Canonical and Zoological Concepts Regarding Animal World.

No.	Concepts 1	Canonical 2	Zoological 3
1.	Ways of Study	20-40	12 (No repetition)
2.	Taxonomy	See Table 2	See Table 10
3.	Development	Through completions/vitalities developing gradually	Simultaneous appearance of parts and then gradual development

1	2	3
4. Life Energy	10 Types of Vitalities.	Life Energy accepted as one.
5. Transits	4	2 (No care for hell and heaven).
6. Senses	2, 3, 4 & 5 senses (mind only in 5-sensed).	Invertebrates : 2-4 senses with brain Vertebrates : 5 sense with brain.
7. Bodies	3 gross+2 fine	Gross body with many fine subparts.
8. Sight	4-sensed : by eyes only, 5-sensed : 4 ways.	Eyes, Mind and Instruments.
9. Gender	2, 3, 4-sensed : Neuter, 5-sensed : 3 genders	All sexuals may have any of 3 lenders
10. Reproduction	2, 3, 4-sensed : a sexuals, 5-sensed : Uterine/A-sexual.	All sexuals but a few.
11. Number of Phyla	79-89 X 10^{12}	—
12. Birth places/ species	8.4 million	—
13. Population of animals	8 X 10^{28}	—
14. Population of men	10^{28}	4.2 X 10^{9}
15. Population of Women	75% of men	Little over 50%
16. Activities (Physical)	4	Acceptable
17. Size/Height	10^{-18} cm.-10,000 km.	Minimum and maximum limits not certain.
18. Life-span	48 minutes to 3 palyas	Not certain about these limits.

1	2	3
19. Shapes of Vagina	3	5
20. Volitional qualities	Many studied	Details not available
21. Structural details	External	Internal, finer
22. Classification	External similarities, qualities.	External/Internal qualities.

Jain[34] has shown that the Jaina *Yojana* should be taken as equal to 6664 kms. (app. 4000 miles) leading to a value of innumerable as a number high above 10^{17}. If calculations are done on this basis, many more astronomical quantitative statements may be obtained in comparison to current values. These differences can not be ignored on literary grounds as a quality of language to depict excessively. They must be rationalised to be reasonably intelligible.

Under these circumstances, it is very difficult to make any comments except to suggest that the situation regarding canonical contents about the world of mobiles needs deeper studies and clarification to trace out the cause of these differences. The present scientific mind has been going very touchy about religion because of the discrepancies being discovered due to newer scientific investigation. This situation can be rationalised, at present, by assuming that the canonical contents belong to an ancient or medieval pre-instrumental and not too rigorous mathematical era when similar postulates are found in many parts of the world. It must, however, be admitted that the Jaina details are comparatively ahead of the times they represent. And as such, they form one of the milestones in the history of science. They should not form part of integrated religion which makes these details as a matter of faith rather than intellectual and experimental observations.

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Section Five

Food and Medical Sciences

Foods and medicines are essential to sustain and maintain life. They are also necessary for religious performance and moving towards spiritual development through austerities. The Jaina seers have dealt with these subjects and their descriptions are very interesting and useful. This section has two chapters :

(i) Food sciences and

(ii) Medical sciences.

They deal with the canonical contents on these topics. Though there is great similarity in material inferences regarding object and functions of food and medicines with respect to the current times, however, the approach to physical descriptions have some basic differences which allow us to gauge the gradual fineness attained in these fields over the canonical periods.

Chapter 16

Food Sciences

No living unit in the world can sustain itself without food which could be solid, liquid (drinks), gas (air) or energy (solar). The Jaina canons contain a good amount of description about different aspects of food science starting from their very first book of *Ācārāṅga*. As Jainism is initiated with ascetic bias, the early books contain details about ascetic foods and rules regarding preparation and diets. However, it is only the common house-holds that move on to ascetic stage. Hence the rules may apply to them also, though not with that much restrictions. The early books of *Ācārāṅga, Daśavaikālika, Mulācāra, Bhagavatī Ārādhanā* etc. contain mostly ascetic rules while *Upāsakadaśā, Cāritraprābhṛta*[1], *Tattvārtha-sūtra*[2] (18 aphorisms), *Ratnakaraṇḍaśrāvakācāra*[3] have given householders' rules about their food and behaviour. Later, Jinasena (*Ādipurāṇa*), Somadeva (*Upāsakādhyayana,* 10th century) Amṛtacandra (*Puruśārtha-siddhupāya*), *Amitagati*-2 (*Amitagati-śrāvakācāra,* 11th century), Basunandī, Padmanandi (11th century), Āśādhara (12-13th century), Daulata Rama Kasalivala (18th century), Ācārya Kunthusāgara (20th century) and others have written about householders' food and behaviour. It seems that later Jaina scholars felt the importance of common-men as protectors of prestige and importance of ascetics[4]. It is, therefore, highly praiseworthy that the *ācāryas* took care of common men and directed them towards their good code of conduct including food.

Definition of Food

Food is necessary for existence and longevity of every living being. There are generally two types of living beings – self-sustaining and parasitic. The first ones produce their own

food while the latter ones feed on others. Plants come mostly under the first category while all other beings under the second category. The canons contain materials about foods for both of these categories. Before one could describe, one must have an idea about the term food itself.

The canons have associated this term with many other ones. These are such as food – variform (*Āhāra vargaṇa*), food completions (*Āhāra paryāpti*), food renunciation (*Āhāra pratyākhyāna*), food affliction (*Āhāra pariśaha*), food donation (*Āhāra dāna*) instinct (*Āhāra Sañjñā*) and ejectable body (*Āhāraka śarīra*). These terms represent various normal and religious aspects of food. However, these terms do not indicate about the definition of food.

Normally, the individuality of man is the resultant of many factors like tradition, trait, environment, psychology, society, genetics and food etc. The food is one of the most important of them. There are some maxims, "As you eat, so your mind" or "As you drink, so you speak". These represent the effects of food on our mind and body. These maxims are related with time and place and they are psychologically very important[5]. The religiously held *kārmic* theory states that the food causes to develop body, its shape, its different parts, joints, bindings and other physical forms. The food is also intaken when there is more than one-instant transitional motion[6].

The food is called *'Āhāra'* – a word composed from two words – *Ā* (from environment or all sides) and *Hāra* (intake). This means the materials which are intaken from all types of surroundings. Pūjyapāda and Akalaṅka[7] define food as intake of material aggregates causing the build up of gross bodies and their functional energies. Thus, all physical materials intaken through diets are called food. Besides, the Jainas postulate that many activities and volitions like knowledge, sight and quasi-karmas like laughter, sorrow, fear, hatred, desires, sex-feeling etc. are also mattergic by nature[8]. They are also intaken

from surroundings. Their intake should also be called food. Thus, the definition of food is more generalised than the scientific one. It includes the emotional elements as well besides physical intakes. That is why the Jaina scholars have postulated its psychological effects too alongwith physical effects since early canonical periods. In contrast, these effects have been co-related with food by scientists in late last century.

Need for Food

Jaina scholars have described their observations to indicate the need for food. *Uttarādhyayana*[9] tells us that the body becomes weak, the bones, joints etc. become clearly observable and sometimes sound while walking and its work capacity is reduced in absence of food. The author of *Mulācāra*[10] suggests the need for food on two counts : (a) physical and (b) spiritual or psychological. Essentially, the spiritual object is served only through physical objects. It is said, "The body is the first means to follow religion" These are given in Table 1 alongwith scientific points for the need of food. Āśādhara[11] suggests its need for maintaining the body. *Sthānāṅga*[12] tells us that food leads to beauty, happiness, nutrition, strength and catalysation for various activities. The strength represents disease-resistence and lustre of the body. Svāmīkumāra[13] assumes thirst and apetite as natural diseases which are satisfied by food. He feels that food leads to maintain the vital fluids in the body and to practice and study the canons. Kundakunda[14] also agrees that it is the food which converts into flesh and blood etc.

It is, thus, clear that the canonical objects of food are the same as we feel daily. Expressed in modern language[15], one can say that the body has two functions – general and specific. The general functions are respiration, digestion, excretion etc. while the specific actions are growth, livelihood, work, reading, writing, performing austerities etc.

The food scientists have postulated three additional objects of food based on cellular structure and mechanism of

the living body as also tabulated in Table 1. These objects are not generally found in canons directly.

Table 1 : Canonical and Scientific Objects of Food

(a) Canonical	(b) Scientific
(i) *Physical*	
1. Food increase strength (energy) of the body.	1. Food supports the basic and specific activities of the body.
2. It increases the longevity.	2. It supports the maintain-ance, repair and procrea-tion of body cells.
3. It gives activity (work capacity).	3. It supports resistance to diseases in the body by body mechanism.
4. It makes life enjoyable.	4. It balances and controls body mechanism.
5. It increases the lustre of the body.	
6. The natural desire of apatite is satisfied.	
7. All the vital fluids remain working.	
8. It also serves as medicine.	
(ii) *Spiritual/Psychological*	
9. It leads to serve others.	
10. It supports the austerities and meditation.	
11. It is the means for the end object of spiritual develop-ment (salvation).	
12. It is necessary for religious performances.	
13. It makes one easy to learn *knowledge of the inner and outer.*	

The scientists suggest that food is required for development, repairs and pro-creation besides maintainance of the body. This fact is clear from the changes which take place when one change from foetus to a child, young, adult and old and experiences the vitality with quality foods while sick.

The twentieth century scientists found that nothing could be done without energy. The above body functions are not without exceptions. Thus, this is easily guessed that the different constituents of the foods supply the necessary energy for body functions. This becomes possible through biochemical, physiological and chemical changes during metabolic processes of foods. It is now known that a normal man needs about 2000 calories per day. Thus, our food must supply this needed energy during its metabolism. Accordingly, scientists would define food as intake of such solid or fluid materials which could supply the necessary energy to the body. This scientific definition is a detailed form of canonical one which has quantitative aspects also besides qualitative one.

It must be noted here that the term *Āhāra* includes food materials as well as diets. Not all material could be dietary.

Classification of Foods

Jaina canons classify foods on two bases : (a) constituents of diet and (b) method of intake by the body. The first type of classification is given in Table 2. It indicates that primarily, there are four constitutents of foods. There is some difference in the names and meaning of some of them (*Aśāna, khādya, Bhakṣya, Pāna, Peya*). It seems there were only two components of food in early days – (a) solid (*bhakta, bhojana*) and (b) fluids (*pāna*). They are denoted as *Bhakta-pana* or *Pāna-bhojana*. It is to be seen when and how the change of position of the two words took place[16].

Prajñāpanā[17] indicates three classes of foods : (i) living (earth, water etc.), (ii) non-living (minerals etc.) and (iii) mixed. This suggests that four or six classes of foods are a

Table 2 : Constituentwise Classification of Foods.

UTN	PRJN	DSV	MR-1	MR-2	RKSR	SGDT	AGDT	Examples
1. Solids	Living	Solids	Solids	Solids	—	Solids	Solids	Cooked rice etc.
2. Fluids	Non-living	Fluids	Fluids	Fluids	—	—	Fluids	Water, Milk.
3. —	Mixed	Raw/dry fruits	Raw/dry fruits	Raw/dry fruits/sweets	Raw/dry fruits	Raw/dry fruits/sweets	Raw/dry fruits	Sweets, dry fruits
4. —	—	Tasty	Tasty	—	Tasty	Tasty	Tasty	Spices, cloves etc.
5. —	—	—	—	sweets/de-natured fluids	—	—	—	Starchy sols
6. —	—	—	—	Licks	Licks	—	—	Pudding, Sauce Chatni, etc.
7. —	—	—	—	Potables	Potables	Potables	—	Drinks
8. —	—	—	—	—	—	—	massaging/annoints	Oil massaging
2	3	4	4	6	4	4	4	-

later development. Mehta[18] has suggested to include plant products and medicines also as foods on the basis of *Āvaśyaka-sūtra.* However, these could only be casual foods rather than regular foods. In these categories, the terms *Aśana, Khādya, Bhakṣya,* should be taken as synonymous. However, differentiation could be made. The solid components in the cooked form could be *aśana* or *bhakṣya* while the raw fruits or fat-cooked solids could be *'khādya'*. Nevertheless, a good clarity in the meaning of these terms is required. Similarly, the terms *'Pāna'* and *'Peya'* should also be clearly differentiated. The early books[19] classify potables in three forms – *Pāna* (alcohols), *Pānīya* (water etc.) and *Pānaka* (fruit juices etc.). When the meaning of *Pāna* changed into non-alcoholic liquids, has to be looked into. Āśādhara[20] has included massaging also in foods exemplifying it by oil massaging. This means some intake of oil particles in the body. The term *'khādya'* here includes the term *'aśana'* also and *'peya'* should be taken to mean *'pāna'* also. The term *'lepa'* seems to be little off here until it means massaging type. *Vṛhatkalpa Bhāṣya* indicates three types of foods for ascetics which point out an ascetic diet devoid of fats and tastes. However, the terms 'massaging or *lepa*' could be taken as a form of medication and in general, they could be included in the term 'tasty matter' (*Svādya*).

The source of six classes in *Mulācāra*[21] with some duplicity requires a search. Despite changes in names and meanings, the canonical four classes of foods still hold ground. It is surprising that Āśādhara, authoring two books, gives the classes differently in them. In one, he nearly follows Samantabhadra, while in other, he follows *Mulācāra.* Does this mean different classes for the ascetics and the house-holders ? The modern scholars have to critically examine this point. However, it is clear that these classes have developed from two to four in due course of time.

The detailed description about solid class of foods is not generally available. These foods pacify the hunger. The solid

cereals or grains may be included in this category. The early literature[22] mentions 24 varieties of grains though Śrutasāgara Sūri of later period mentions only 7 or 18 varieties[23]. Currently, sugarcane and corriandar are not taken as grains because of their different structure. Fortunately, Śrutasāgara does also not mention them. Table 3 (a & b) gives this list on a comparative basis.

Table 3 a : Different Types of Grains and Potables.

	Daśavaikālika	*Niśīthacūrṇi*	*Śrutasāgara*	
	1	2	3	4
[A] *Carbohydrate Cereals*				
1.	Wheat	Wheat	Wheat	Wheat
2.	*Śāli* Rice	*Śāli* Rice	*Śāli* Rice	*Śāli* Rice
3.	*Brīhi* Rice	*Brīhi* Rice	–	–
4.	*Śaṣṭika* Rice	*Śaṣṭika* Rice	–	–
5.	Barley	Barley	Barley	Barley
6.	*Kodrava* Grain	*Kodrava* Grain	–	*Kodrava*
7.	–	*Kaṅgu* Rice	–	*Kaṅgu* Rice
8.	*Kaṅginī*	–	–	–
9.	*Ralaka*	*Ralaka*	–	*Ralaka*
10.	–	–	–	*Jvāra* (*matha-vainava*)
[B] *Proteinous Cereals or Pulses*				
11.	*Mūṅga*	*Mūṅga*	*Mūṅga*	*Mūṅga*
12.	*Urada*	*Urada*	*Urada*	*Urada*
13.	Black Gram	Black Gram	Gram	Gram
14.	*Arahara*	*Arahara*	*Arahara*	*Arahara*
15.	Lobia (Cow pea)	Cow pea	–	Cow pea
16.	Peas (Mutter)	Peas	–	–
17.	*Masūra*	*Masūra*	–	*Masūra*
18.	*Motha* (Lentil)	–	–	Makuṣṭha
19.	*Niṣpava*	*Bhatavanāsa*	–	–
20.	*Kulthī*	*Kulthī*	–	*Kulthī* (Batar)

1	2	3	4
21. Anuka beans	Anuka beans	–	Beans
22. –	Kaloya beans	–	*Vana Mūṅga*
[C] Fatty Cereals			
23. *Tila*	*Tila*	–	*Tila*
24. Linseed	Linseed	–	–
25. –	–	–	Mustard
26. *Tripuda*	*Tripuda*	–	–
[D] Miscelleneous			
27. Sugar Cane	Sugar Cane	–	–
28. Corriander	Corriander	–	–

Table 3b : Potables (*Pānakas*).

SGDT	BA	Peyas
1. *Ghana* (Curd etc.)	Lemon Juice	*Pāna* (Alcohols)
2. Fluids (Tarala)	Fruit Juice	*Pānaka* (Fruit Juice)
3. Licky (*Lepī*)	*Lepī* (Curd)	*Pānīya* (Water)
4. Non-licky	*Alepī*	
5. *Sa-siktha*	*Sa-siktha* (milk)	
6. *A-siktha*	*A-siktha*	

Similarly, though *Ācārāṅga*[24] gives a list of 21 potables, this seems to have been overlooked. Munī Nathamala mentions three varieties of potables out of which Āśādhara[25] selects *'Pānaka'* as a general term. He classifies them in six varieties much similar to *Bhagavatī Ārādhanā*[26]. These include normally all types of potables. The *Vrata-vidhāna-saṅgraha* counts fermented or denatured liquids separately but it could be included in *pānaka* itself[27]. The potables are said to enliven the activity of vital fluids in the body. The discussion on other categories will be made at appropriate places.

Classification of Foods on Methods of Intake

Bhagavatī and *Prajñāpanā*[28] mention three classes of food based on methods of intake : (i) absorbable (energy,

oja-hara), (ii) diffusible (through hairs, *roma-hara*) and (iii) morsel (*kavalāhāra*). In contrast, Vīrasena[29] has given six types of foods on this basis : (i) absorbable, (ii) morsel, (iii) Kārmic intake, (iv) Quasi-kārmic intake, (v) Mental/emotional intake and (vi) intake by covering or massaging. The last one may be a form of diffusible intake. It is also said there that the living beings under transitional movements, salvateds, extricating soul-points (*samudghāta-gata*) and omniscients with and without activity stage do not have any intake. Lodha[30] does not seem to be right when he translates absorbable food as a process of assimilation. The term means a process similar to digestion starting after the intake. The term, *oja-āhāra* (intake of, say, solar energy) should mean intake by absorption which could occur on outer or inner surface. The surfacial absorption of solar heat or air by our body or plants is an example of this process. That is why, Mahāprajña[31] has called this class as energy intake.

The *roma-āhāra* (intake through soft skin hairs) may be called the process of diffusion or osmosis. It always occurs in plants and body cells. Intake by skin and touch consists of the same process, involving hairlines. It also occurs during foetus development. It is a constant intake. It is invisible to the eye, but now it could be verified by experiments on plants. Vīrasena's massaging may also partially involve this process.

The *'kavalāhāra'* (morsel, mouthful or swallowed-up) is the intake of solids or liquids by mouth.

All these three classes of foods are common to all living beings (except 1-sensed). The feeds-in-actuality class of *Sūtrakṛtāṅga* involves these three types of intakes.

However, when the Jaina *ācāryas* observed effects of emotions and commotions on living beings, they included the different karmas, quasi-*karmas* and pshychic volitions among the class of foods. It is surprising that these ettects were observed qualitatively in India in early centuries. In reality, all these three types are forms of fine energies of different nature.

These could be intaken from inner and outer environment resulting in corresponding effects. Thus, the last three intakes of Vīrasena represent the specific materials rather than methods. One could, therefore, agree to the three categories of foods on the intake basis. This classification is not specifically found in current food science books, though the methods are mentioned in appropriate places there.

Sthānāṅga[32] mentions a third method of foods based on the method of cooking. It consists of four types : (i) Fried, (ii) Cooked, (iii) Natural, fruits etc. and (iv) Fermented. These types are self-explanatory.

Sūtrakṛtāṅga[33] has an altogether different and intellectual way of food classification based on positing technic. Accoordingly, there are five types : Positing by name, representation, substance, region and actuality. Out of these, the first two are just literary. In the third, mention of six types of food substances have been made :

(i) Earth-bodied food	Salts and minerals	Solids
(ii) Water-bodied food	Water, juices and other fluids	Fluids
(iii) Fire-bodied food	Absorption of solar heat etc.	*Oja-āhāra*
(iv) Air-bodied food	Intake of air, absorptional, nasal, morsel.	
(v) Plant-bodied food	Intake of plants/plant products	
(vi) Mobile-bodied food	Intake of living beings in any form.	

All these types may be living, non-living or mixed. This is a mixed classification consisting of intakes and constituents. It might be older also.

The regional food is a general specific food available and intaken by people in different regions. Rice in south, mustard oil and *Sattū* in Bihar, Maize in Mewar etc. are examples. This type may include many of the six foods.

The actuality-based foods are specific food substances of interest based on colour, taste, smell and method of cooking. These foods are intaken by absorption, diffusion and swallowing.

In contrast to what has been said earlier, *Sūtrakṛtāṅga* mentions that the absorption of food through luminous and kārmic body takes place during the undeveloped state of the living. This means that absorption is the first stage of food intake at the nucleation of life. However, it may not seem correct as has been said earlier. The *Cūrṇi* and *Vṛtti* of *Sūtrakṛtāṅga* have better meanings for this intake which is a form of *oja-āhāra*. Diffusion method is applicable through skin and touch and is continuous. The morsel food is intaken through tongue and taste. The *oja-āhāra* is intaken through sense of smell, sight and hearing. There seems to be some difference in the meaning of these terms, though not substantial, in the opinions of authors of *Vṛtti* and *Cūrṇi* of *Sūtrakṛtāṅga.*[34]

The *Sthānāṅga* and *Sūtrakṛtāṅga* classifications have never been popular and, therefore, constituent and intake based classifications have been followed by later scholars.

Scientific Analysis of Constituent-wise Classification

The modern scientists[35] agree to six main constituents of foods as shown in Table 4.

Table 4 : Scientific Food Constituents.

Name	Examples	Energy
1. Carbohydrates	Wheat, Rice, Oats	4 cal./gm.
2. Fatty Cereals	*Tila,* Mustard, etc.	9 cal./gm.
3. Proteins	*Mūṅga, Urada,* gram	4 cal/gm.
4. Minerals	Vegetables, Fruits	
5. Vitamins/Hormones	Carrots, *Ānvala* etc.	
6. Water	Purified/filtered.	

They classify the natural food materials on the basis of their main constituents, though they contain other useful

ones in small amounts. The microconstituents control the digestibility, side effects and energy metabolism of the main food material.

If we study the canonical material on this basis, we find different constituents representing specific food group as below :

Aśana	solid food materials.
Pāna	liquid food materials.
Khādya	dry/raw fruits, sweets.
Svādya	savoury materials of resistence increasing nature.

In canonical days, it was not possible to classify foods on the basis of their chemical analysis. Hence they could classify on the basis of their states (the concept about gaseous state was only dormant).

In the first canonical category of 7/18/24 varieties, one finds the materials composing the first three categories of the scientists. Taking *'pāna'* as liquid foods, it includes water, fruit juices, milk, curd, sour waters, raisin water and other such materials. This class also consists of materials included in all the scientific classes. Scum of rice (gruel), raisin water etc. belong mainly to carbohydrate class, Curd is proteinous; fruit juices belong to mineral/vitamin category. The liquid foods maintain the physiological transport and balance in the system. The scientists classify liquids also on the basis of their main constituents except water. The liquid foods contain two other scientific categories besides the first two ones.

The examples given under *khādya* category (Table 2) indicate that it consists of mainly raw/dry fruits and foods made from mixtures of scientific classes 1-3. The examples of canonical category 4 could include categories 4-5 of the scientists.

The comparative description indicates that canonical constituentwise classification is very general. It looks, however,

sufficiently mixed and vague with respect to the current view. It has to be expressed in a better way. Nevertheless, the canonical categories indicate that they include all the foods containing components under scientific classes. Madhu Sen[36] seems to be right to suggest that theoretically all the scientific constituents are indirectly included in foods of the canonical periods.

One must, however, point out that the canonical examples under categories suggest an interesting fact. They do not contain vegetables in general. It is not clear what category they could be included in. The canons, nevertheless, discuss the conditions under which they could be eaten.

Time of Eating

Kundakunda[37] and Āśādhara[38] tell us that one should take foods for physical and psychical health depending upon time, place, emotions, digestion capacity and availability of food materials. This is as much applicable to house-holds as to the ascetics. *Niśīthacūrṇi*[39] tells us that there is difference in habits and traditions regarding food in different regions of the same country. The three humours are specifically coordinated in the body under different places and times. These facts limit the intake of different constituents in foods. The different seasons also effect the nature and quality of food. It is said that rough food should be taken in spring, cold natured or endothermic foods should be taken in summer and rainy season and hot oily food should be taken in cold season. Ugraditya[40] goes still further to divide even the different part of the day in different (six) seasons suggesting to eat accordingly.

Bhagavatī Ārādhanā[41] also indicates the effect of regional tradition and seasons on the time and quantity of food intaken. The food itself should be psychologically catalysing and emotionally satisfying. This depends upon the purity of food material and method of cooking. The mendicant feels satisfaction by taking even boiled, non-oiled but pure food devoid of 46 defects due to materials, preparation and the

cook. The households, however, have to take food under most trying conditions in contrast.

Ugraditya[42] suggests, on medical grounds that the time for taking food should be taken as that when :

(i) Excretions have taken place normally.

(ii) Body may be feeling light and happy.

(iii) Apatite is being felt and hunger-fire has started kindling.

(iv) Heart is healthy and three humours are in equilibrium.

(v) Excretory vital airs have passed normally.

Sthānāṅga[43] mentions food instinct arises due to : (i) emptiness of stomach, (ii) fruition of hunger-feeling *karma,* (iii) interest and (iv) thinking about foods. Nemicandra Cakravartī has stated the time for taking food as that when one feels psychological feeling for hunger, pre-mature fruition of painful feeling *karma* and interest and action on seeing foods. Āśadhara[44] suggests the time for taking food should be taken between 45 minutes after the sunrise and 45 minutes before the sunset for common man. In contrast, *Mūlācāra*[45] suggests the time of about the middle of ten hours between 75 minutes after sunrise and 75 minutes before the sunset for the ascetics (i. e., roughly about at noon). The best people take meals once a day while the better ones may take meals twice a day. The night-eating is not permitted in Jainas. This means a common man spends about half his life in fastng. Night-eating is prohibited for Jainas for proper health, intelligence, non-violence and protection of life of other beings. This practice is said to be one of the signs of being a Jaina.

According to *Mūlācāra* and *Uttarādhyayana*[46], the times of meals is roughly noon or third part of the day. It seems quite alright in the country of agriculturists. However, currently, the time for first meals lasts upto the noon only. Mahāprajña[47] opines that actual time for meals should depend upon the time of cooking which varies from place to place. This concept of

time for meals and the interval between two meals stands scientifically supported today.

Quantity of Food

How much one should eat ? This does not find mention in the canons with reference to the house-holders. However, *Bhagavatī-sūtra, BA, Mūlācāra, AGDT* and other texts mention it for the mendicants. The maximum quantity has been mentioned as 32 mouthfuls (*kavala,* grasa) for male mendicants and 28 for nuns[48]. *Aupapātika-sūtra*[49] mentions that one handful (*Grāsa*) unit of food is equivalent to the weight of an egg of a common hen. In contrast, Basunandi has said in *Mūlācāra-vṛtti*[50] that it is equal to 1000 rice grains. The assumption of egg as a unit suggests its common use in canonical days. Later, it must have been proscribed on non-violence ground and rice grains might have been taken as unit. The rice grains have not been specified. However, it would be proper to assume them to be unbroken grains of uncooked rice.

Generally, the weight of a normal egg varies between 50-60 g. Accordingly, the maximum weight of daily diet of a male mendicant is equivalent to 50 x 32 =1600 g. while it is 50 x 28 =1400 g. for nuns. This calculation may surprise the twentieth century man, but it should be taken as normal in the days of foot-walkers and agriculturists. In contrast, medium rice grains weigh about 12-15 g. On this basis, the weight of food for males is 32 x 15 = 480 g. and for females is 28 x 15=420 g. This unit, therefore, does not seem to be realistic. This unit requires modification. Could the cooked rice grains be taken as unit for handfuls ? These grains have about three times the weight of uncooked rice. Per chance, this manipulation also does not lead us to reality. *Taṇḍulaveyaliya*[51] fortunately solves the problem reasonably when it assumes a mouthful unit as equal to 2000 full rice grains of specified types.

Almost all canons agree on 32/28 mouthfuls of food per day. But the definitions of this unit vary. This is the amount of food for a single meal for a mono-mealing mendicant. It

could also be the amount for a bi-mealing household too. Normally, it should have a higher amount. In the days of four meals-a-day, it could mean a full day's diet. The balanced diet concept suggests an amount varying between 1250-1500 g. However, the canonical meals include water also which is not taken into account in current dietics.

Taṇḍulaveyaliya[52] is a specific miscelleny which has given a calculation about how much a man can eat in his one hundred years of assumed life. On the basis of 32 handfuls of 2000 rice grain-equivalent each meal, the above canon gives the following amount for hundred years (Table 5). The current equivalents are given on the basis of 1 *Prastha* = 0.8 kg. The back calculations give column 5 and 6 in the table 5. A column of current dietary statistics as per Indian Council of Medical Research, 1980 is also given for comparative purposes[53]. This column suggests the current modified pattern of diets. It is clear that diets in canonical days must have been poor in vegetables as they are not mentioned in this miscelleny too. Secondly, the canonical diets must be heavy because of their high fatty contents.

Table 5 : Amount of Foods Eaten by Man in 100 years.

No.	Item	Amount Consu-med	Current Equivalent (App.)	Diet/Day	ICMR, 1980
1.	Rice (Carbohy-drates	22.5 *Vah*	576 Quintals	1600 g.	450 g.
2.	Pulse (*Mūṅga,* Proteins)	5.5 *Kumbha*	14 Quintals	38.4 g.	40 g.
3.	Oils & Ghee (Fats)	3.0 *Vah*	76.80 Quintals	210.0 g	45 g.
4.	Salt	2250 *Prastha*	1.8 Quintals	4.9 g.	–
5.	Milk & Vegetables	–	–	–	250 g.

The canons indicate about the divisions of food compo-

nents. *Mūlācāra*[54] suggests four parts of the stomach. Two parts should be filled with solid foods, one part to be filled with liquid or watery foods and one part should be kept empty for proper air or humoral transports. This means a fourth part of the diets should be liquids. This will maintain good health and ensure easy and normal physiological actions. Nemicandra Sūri[55] divides the stomach in six parts. Ugraditya does not mention the amount of food but he also has some divisions. He suggests eating of oily and sweet foods in the first stage, salty and acidic materials in the second stage, juices of all types in the third stage and the meals should be finished with liquid foods. The normal meals should have pulses, rice, cooked materials, vinegar, butter, mild and warm/cold water. One must drink water in the end. This also suggests that one should eat about half of the apatite.

The canons indicate that high nutritious foods, half-cooked and green foods cause stomach-ache, rheumatism and dull intelligence[56].

The above division of food constituents do not seem to fit in the current food science concepts. They also do not seem to include the concept of balanced diet. That is why most mendicants suffer from many deficiencies of nutrition and their body does not kindle from the fire of austerities and performances. Though theoretically this fact does not have any importance, still it has a high value on practical counts.

Eatables and Non-eatables

The Jaina scholars have discussed criteria about the eatability of different foods. *Ācārāṅga* mentions four criteria of intake[57].

(i) The materials must be raw.

(ii)The material must not be uncooked or half-cooked.

(iii) They must be heated, treated or pasteurised and dis-infected.

(iv) The materials should not have less eatable and more non-eatable parts. Various types of non-eatables are also

mentioned in this canon. They fall under 17 categories. They are : (i) lotus roots, (ii) powder of long pepper, ginger and chillies, (iii) hanging fruits like mangoes, (iv) sprouts of fruits and trees, (v) powder of five *udumbara* tree fruits, (vi) water-born vegetables, (vii) vegetables born from different parts of the plants, (viii) denatured sugarcane etc. (ix) garlic and its parts, (x) plant seed-foods, (xi) half-cooked leafy vegetables, rotten oilcakes, denatured milk-products, (xii) soft fruits of wood apple etc., (xiii) fruits of specific trees like Aśṭhika, (xiv) different parts of sugarcanes, (xv) green beans and peas, (xvi) multi-seeded or stony fruits (watermelon, cucumber, custard apple, papaya, lemon, pomegranate etc.) and (xvii) thorny fruits like pineapple, jackfruit, etc.

The list of materials above do not pass the criteria of eatability either partly or wholly. These criteria have been included directly or indirectly by Samantabhadra, Pūjyapāda, Akalaṅka, Bhāskaranandi, Āśādhara, Śāstrī and others in their attempt to theorise the basic issues involved in non-eatability of different food substances. They are based not only on non-violent approach but many popular ideas also. Man being a parasitic animal, these bases require independant discussions.

Table 6 summarises the issues where seven categories could be somewhat condensed to fewer numbers[58]. However, the literature mentions 22 types of foods as non-eatable under the above criteria. This number got fixed by about thirteenth century. Before that, categories were mentioned, not the fixed number. Sādhvī Mañjulā[59] mentions that they have been first given in *Dharma-saṅgraha*. Later on, many authors have pointed them out. Table 7 gives the list from three sources. Each list seems to have some addition or subtraction despite maintaining the number. It seems many names have been added from time to time and that is why there is some duplication in names and categories. Later on, many authors have pointed them out. For example, the category of denatured materials could include alcohols, butter and some fermented mixed

eatables like *Dahī-baḍā,* etc. The multi-seeded materials could include brinjal also. These 22 non-eatables could now be classified under four major heads as shown in Table 7 where many more new non-eatables may be included. These should be scientifically evaluated under the newer knowledge. This is also an age of multi-constituent food materials which also require consideration regarding their eatability.

Table 6 : Canonical Basis of Non-eatability.

	Basis	Cause	Examples
1.	Destruction/Violence of mobile or more than 1-sensed living beings.	Involves violence of more developed living beings.	5 udumbara fruits, denatured materials honey, di-sectionals.
		Violence of mobile beings.	Flesh, night-eating
2.	Violence towards non-mobile living beings.	Violence towards general/individual plants.	Roots/tubers, multi-seeded fruits, raw fruits, sprouts
3.	Drunkenness/laziness.	Mental Imbalance, madness, idleness.	Alcohols, addicting compds/drugs/products.
4.	Popular Opposition	Bad smell, low quality mentality	Onion, Garlic, etc
5.	Small eatable with large non-eatable.	Violence to plants	Sugarcane, watermellon, wood apple etc.
6.	Undesirability/Disease carrying quality	Personal preferences	Unfiltered water, Bulbous roots (many) etc.
7.	Rawness/Uncookedness, uncutness	All plants are living at the begnning.	–

There is a large amount of traditional and intellectual discussion about the eatability of roots, tubers or rhizomes. Religionists point out that they create an unpious mentality and

hence should not be eaten. They have a general plant nature consisting of many living cells. The so-called non-violence approach lends support to them. However, the early canons like *Mūlācāra*[60] and *Ācārāṅga* have indirectly pointed out their eatability on the condition of their de-livening process by cooking, heating, cutting, ripening etc. All canonical scholars are agreed to their non-eatability on raw basis. Jain, RK[61] has supported this point on health grounds. When these materials came under complete non-eatability status-is worth looking into. In addition, Jaina scholars of later date have pointed time limits for eating certain denatured materials[62]. Time limits of cereal powders, curd and milk, ghee and many other food materials have also been pointed out. This is scientifically correct. A critical examination regarding non-eatables is necessary[63].

Table 7 : Twenty-two non-eatables from Three Sources.

Dharma-saṅgraha	*Jīva-vicāra*[64]	*Kṛyākośa* (DR)[65]
1	2	3
(a) Fermented/Denatured		
1. Alcohols	Alcohols	Alcohols
2. Butter	Butter	Butter
3. Denatured liquids	Denatured liquids	Fermented fluids
4. Di-sectables	—	Di-sectables, Gholabada
(b) Preserved Materials		
5. Pickles, Jams, Jellies etc.	Pickles etc.	Pickles etc.
(c) Violence to mobile/non-mobile beings		
6-10. Five Udumbara fruits	Five Udumbara fruits	Five Udumbara fruits.
11. Flesh/meat	Flesh/meat	Flesh/meat
12. Honey	Honey	Honey
13. General plants	General plants	General plants

1	2	3
14. Multi-seeded plants	Multi-seeded plants	Multi-seeded plants
15. Brinjal	Brinjal	Brinjal
16. Unknown fruits	Unknown fruits	Unknown fruits
17. Low quality fruits	Low quality fruits	Low quality fruits
(d) Miscelleneous		
18. Poisons	Poisons	Poisons
19. Ice	Ice	Ice
20. Hailstorms	Hailstorms	Hailstorms
21. Earth-salts	Raw Earth Salts	—
22. —	Unbaked Salts	—
23. Night eating	Night eating	Night eating

Dishes in Canonical Periods

Though one does not find the methods of cooking various items of food value in canons, but they mention many eatables like fruits, vegetables, flowers, sweetmeats etc. *Daśavaikālika*[66]– one of the earliest secondary Jaina canons mentions many such items which give us an idea about what the ascetics and common people did eat those days. They are given in Table 8. The items also represent the commonly available food materials.

Table 8 : Different Food Items Mentioned in *Daśavaikālika.*

	Vegetables 1	Sweetmeats 2	Fruits 3
1.	Radish	Thin cake of seasame/ sugar	Sugercane
2.	Ginger	Molasses	Tinduka
3.	Pumpkin	Fried sweetcake (*Puā*)	Woodapple (*Bilva*)
4.	Lotus root	Pulverised parched gram-wheat-barley powder (*sattū*)	Plums

	1	2	3
5.	Palśa root	Fried plum powder/*sattū-ghee*	Beluka fruit
6.	Lotus stalk (*padmanāla*)	Barley/*Urada* flour	*Nīma* fruit
7.	Red lotus stalk (*kumuda*)	Rice/parched rice flour	Kaintha
8.	Mustard stalk	Oil	Belleric Myra-bolan
9.	Blue lotus stalk	Ghee	Citron fruit
10.	Oil cakes	Thick cake of seasame/ jaggery	*Śrīparṇī*
11.	Raw radish	Powders of plum-fruits-seeds	*Priyāla* fruits
12.	Special leaf (*sannīra*)	*Pohā* or *Murru*	Pineapple
13.	Special leaf (Poi Veg.)	Rasālū sweet	Aṣṭhika fruit
14.	Garlic	Honey	Mangoes
15.		Partly fermented juices	Bananas
16.		Cooked rice	Coconuts
17.		Fried thick cake of Flour/sugar (*khajja*)	Palms
18.		—	Water chestnut
19.		Partly fermented washings	Bamboo fruit

Per chance *Ācārāṅga*-2 has many additions to the list suggesting its later composition than DSV. The list of eatable seems to be very small in comparison to the modern days of natural, modified, synthetic and fast foods. Moreover, the contraction of the current world of human beings as a family has made the number of eatables to be virtually innumerable. It has become necessary to sort out their eatability authentically. Samani Kusumaprajñā et. al. have dealt with this point exhaustively.[67]

Nature of Foods : Vegetarian Diets

It is clear from the list of non-eatables that the Jaina canons have prescribed vegetarian food substances to be intaken. Normally, these materials may either be dried plants or plant products. Currently, vegetarians are classified as lacto-vegetarian, vegan and ovo-vegetarian ones. The Jainas have an ideal of being vegans. However, most Jainas are lacto-vegetarians from the very beginning. In early days, vegetarian diets were charged with insufficient nutritiveness by scientists. But now, researches have shown that these can form fully nutritive meals. More and more western people are taking to vegetarian diets now because of their non-violent, environmental and health effects. Many dangerous diseases have been found to be absent among vegetarians. Their pious nature and longevity is another factor. Some so-called deficiencies have been removed by supplementing these diets with soya/ groundnut powders. This system of diets is now gaining prominence in the west on a large scale. Vegetarianism is another characteristic sign of the Jainas.

Foods Taken by Living Beings Other than Human Beings

Bhagavatī and *Sūtrakṛtāṅga*[68] have mentioned about foods intaken by living beings other than human beings. It is pointed out that plants have constant intake from all directions wherein are involved the diffusion of essential salts, water, air and solar heat which are metabolised to give the different parts of the plants gradually. The heterotrophic plants have somewhat different intakes as they survive and grow on others. It is stated that the intake is absorbed, assimilated and transformed in useful form for the plants. There seems to be no excretory wastage in plants as in foetus developments. All intakes are transformed into useful parts of the plants. They generally have *oja-āhāra* and diffusional intakes.[69]

The more developed beings having more than one sense of touch also have intakes from all directions intermittently. They have diffusional and morsel eating. The first one

is without remnant while the other one is partly absorbed and transformed into body and its sustaining energy. The rest is excreted. The transformation of intake in different beings depends on the senses they might have. These beings have intakes through their sense-organs also which are developed from their primary intakes.[70]

There is no mention of specific foods for higher beings but it is mentioned for plants that they take their intake in the form of essences (salts, water, air, calories, etc.) from earth, water, air and other types of bodies. Different terms used in canons in this connection have high similarity with current botanical concepts in a qualitative way. Summary of various disquisition doors regarding foods is talulated in Table 9 which gives many more self-explanatory details too.

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Table 9 : Summary of Disquisition Doors about Foods.

No.	Disquisition	Hellish	Celestials	Sub-Humans	Humans
	1	2	3	4	5
1.	Food instinct	Yes	Yes	Yes	Yes
2.	Nature of food	Inanimate matter	Inanimate matter	Animate, Inanimate, mixed matter	Animate, Inanimate, mixed matter
3.	Period for Food Desires (a) Natural/Unconscious	Incessant	—	—	—
	(b) Conscious	48 minutes	2-9 days-33000 yrs.	48 minutes-2 days	48 minutes-3 days
4.	Quality of Foods (4 in each case)	1. Cold, 2. Icecold, 3. Temperature burning like charcoal, 4. Permanent burning like chaff fire	Cherishable Colour, Taste, Touch, Smell	1. Eatable like heron bird, 2. Hole-living animal, 3. Hated animal flesh, 4. Painful like son's flesh	Solids, Fluids, Raw/dry fruits, Tasty spices
5.	Food material	4-touch/8-touch contacted matter	—	—	—
		Substantive, regional, timal, physical, statal	As in hellish	As in hellish	As in hellish
6.	Partial/wholly intake	Entirety	Entirety	Entirety	Entirety

1	2	3	4	5
7. How much transformation/assimilation ?	Innumerable parts intake assimilated, many more parts excreted unassimilated	—	—	—
8. Transformation	Undesirable forms	Desirable forms	Desirable forms	Desirable forms
9. Take-in and touch	Take uncountless, countless portions, touch-infinite portions.	—	—	—
10. Use of Intake	All Intake is accepted as food	—	—	—
11. Transformation of food	In the form of 1-5 sensed bodies	In the form of 1-5 sensed bodies	In the form of differing number of sense-organs according to senses.	All sense organs
12. Food Intake	Bodies of 1-5 senses	Bodies of 1-5 senses	Depending on senses	Depending on senses.
13. Intake type	Absorption and Diffusion	Absorption, Diffusion, Mental cherishing	Absorption, Diffusion for 1-sensed (b) 3 types for others	Absorption, Diffusion, Morsel
14. Fate of Food (Metabolic processes)	Six Stages — (i) Transformation/Separation, (ii)-(iii) Anabolism, Catabolism, (iv) Fructification or formations of body components, (v) Emotional or Psychological feeling, (vi) Exhaustion or excretion.			

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Chapter 17

Medical Sciences in Jaina Canons

Religion is a way of life involving a code of conduct leading to the best of physical and spiritual happiness of individual and society. It leads to increase in pleasure and reduce the pains. *Sthānāṅga*[1] mentions ten types of pleasures involving attainments and controls. They include health and longevity at the top. These are experienced by reducing ten types of pains[2] due to food, shelter, clothes and diseases of physical, mental, natural, supernatural and accidental nature. It seems the Jaina preceptors did have the idea of proper health as the basis for attaining the four objectives (religion, riches, desires and salvation) in the world. They had in mind that sound mind develops only in sound body. That is why, all the monks were formerly required to learn the science of vital airs or living and attainment of healthy and lustrous body was taken as one of their characteristics.

The Jainas have developed a science of life or *Prāṇāvāya* (*Prāṇāyu*) with the description of quatrained eightfold system[3]. This formed the earliest canon on medical science adopted by Jainas. Though this is not extant now, its contents have been described in other canons. This now forms only one section (12th) of pre-canonical texts under 12th primary canon – the *Dṛṣṭivāda* or canon of apologies and worldly-cum-super-worldly learnings, though this canon is also now extant. However, the studies of this or other canons was limited to the monks only wherein they were not required to practice it publicly to free them from attendant botherations. The times changed and this science became the science for general people and earned the name of skilled learning. That is why, the ash-thread-therapists (*bhutikarma*), physicans and physio-

therapists (specialising in nerves and vital airs) have been included in nine types of skilled persons[4]. It is mentioned that the kings had always physicians with them in peace and war. A large number of physicians, surgeons and veterinarians are mentioned in different canonical stories. It is also noteworthy to learn that the traditional 72 learnings for men and 64 skills for women include many medical skills and practices[5]. The basic importance of this skill can also be inferred from the fact that the religious principles of gem-trio of the Jainas have been also associated with pacification or purification of three defects of the body – right faith pacifying the bile defect, right knowledge pacifying the air (rhenum) defect and the right conduct pacifying the phelgmic defects[6]. It is due to this attitude that a large number of practices have been included in different vows and penances in religious scriptures for spiritual development.

The term *'Vaidya'* or *'Vaidyaka'* denoting a physician or science of physicians indicates that this branch of learning was taken to be all-skill branch where Vedic (spiritual) and physical ailments were taken into account[7]. This also suggests the paramount importance of the *Prāṇāvāya* skill. Though formerly a normal scripture, this has been classified as a demerited, worldly or black scripture by spiritualists per chance later because it leads to longevity in the world[8]. This designation requires reconsideration.

The term *'Prāṇāvāya'* means the science of life and longevity. It is not known whether the scholars defining about the contents of this science were familiar with the details of eight-fold indigenous system (as it includes demonology and toxicology), but it seems that they had an idea of a different eight-fold *Āyurvedic* system which requires a probe. That is why Akalaṅka[9] had defined it as a treatise of eight-fold *Āyurvedic* system together with demonology, toxicology and *yogic* system. A later commentator, Vīrasena seems to have improved this definition in *Jayadhavalā* stating that it deals with

different vital airs, strengths and physiological functions[10]. The traditional Jaina canons also support this definition. This will involve anatomy and physiology also. That is why, these topics are found scattered in Jaina canons like *Bhagavati* and others[11]. Moreover, there were hospitals based on this system in towns like today's Rajagir built by rich persons and the state with necessary facilities for treating the patients[12].

There are some specific points regarding this system which give strong Jainistic impressions on it. Jainism is based on gross and fine non-violence. Any process or practice involving violence is, therefore, practically disregarded by canonical Jaina physicians. That is why, the noted physician Dhanvantari (not the originator of *Āyurveda*) has been shown to attain hellish life afterwards[13]. Thus, the Jaina system mostly avoids the direct use of meat, honey or alcohol in medical prescriptions. It is because of this principle that the dead body dissection has been termed as demerited act. This resulted in poor knowledge in anatomical and surgical fields without any developments. This principle has led to use medicines of vegetable and mineral origin only. The treatment of some diseases and wounds in canons testify this fact. The development of medication by different forms of flowers and their extracts is another example[14]. Even in ninth century, Ugraditya wrote his *Prāṇāvāya* treatise on this basis alone.[15] However, when large number of metals (i. e., mercury) and minerals were known, a system of mastered and synthetic medicines was developed. All chemical practices were also developed. Later authoritativeness in the system led to conservative attitude which marred the progress of this indigenous system. It is pleasing to note that 20th century has made it little progressive under competitive compulsions.

Origin of Prāṇāvāya System

It is observed that almost all prominent Indian systems presume their origin through their supreme lords or their incarnations. *Āyurveda* system originated from Dhanvantari-

an incarnation in *Vaiṣṇava* system, from Nakulīśa – an incarnation in *Śaiva* system and from medical preceptor Buddha in Buddhist system. Similarly, the canonical branch of *Prāṇāvāya* may be assumed to have been originated from the first Jina-Ṛṣabhadeva of the present Jaina era which has been passed on to us through the last Jinas – Pārśvanātha and Mahāvīra and their disciples. *Niṣīthacūrṇi*, however, mentions Dhanvantari to be the originator[16]. This seems to be a non-traditional view and suggests interpolation.

The memorical loss of original canonical instructions of medical science of the Jainas has caused unprecedented disadvantage to this system historically. However, a good number of informative facts and figures are found scattered in almost all canons on the basis of which a study could be co-ordinated to learn about the state of medical sciences in the canonical period. It may be added that the terms – *Prāṇāyāya* or *Praṇāyu* should be taken as equivalent to the term *Āyurveda* which has the same object and methodology, though it is a matter of research which term or system preceded the other. But as things stand, the Jainas used their term until eighth century A. D. and later began using latter term. Thus, currently one may take these terms as synonymous.

Kalyāṇakāraka – a treatise of 8-9th century mentions names of large number of predecessors authoring *Prāṇāvāya* books whose works are unfortunately not available today[17]. These would have been highly valuable to study the gradual development of medical concepts and practices during different periods. Shah[18] and Bhatanagar[19] have mentioned about more than 100 books with their authors during later period between 1200-1950 A. D. to show that the indigenous science of medicines has always been a lively learning among the Jainas. However, the description here will cover a limited period of canons and their commentaries.

Units under Medical Establishment

Per chance, *Sthānāṅga*[20] is the first book mentioning

about four basic units of ancient medical system. They are – (i) the physician, (ii) patients, (iii) nurses and the (iv) medicines (the term used for this is *Auṣadha* which previously meant herbal and plant-based medicines. Later, minerals and prepared medicines have also been included in this term). Besides preparations, administration of medicines to patients is also included here. A fifth unit of community and preventive medicine was added to these four suggesting public health consciousness of Jaina scholars more than two thousand years ago[21]. Ugraditya also confirms these basic units and defines them. They are also the basic units of medical establishment today. This suggests the continuity of structural and external similarity of medical learning during the past and present.

(i) *Physician* : The word should be taken as to mean the indigenous medical specialist and practitioner of ancient times. There is a large amount of ignorance about the quality and quantity of physicians of that period. This does not seem justified. They became masters of their trade by learning under suitable monks in seminaries and monasteries associated with the Jainas besides their hereditary education. The teacher-monks were called *Kalacāryas* or skill-preceptors. The medical scientists of that time were practically creative and theoretically intelligent. They cultivated these qualities as there were no detractions during their learnings in their places like today. The most recent trend in education is also moving in the so-called backward direction in this regard. The physicians of those days worked privately and as civil servants also. They treated the public, individual and even none or both. They were highly proficient in the eight-fold system of medicine current those days[22].

(ii) *Patients* : Though the canons do not contain description about the patients in general; however, Ugraditya tells us that the patients should have confidence and faith in the physician approved by the state. The physicians, on the other hand, should first examine the patient by methods of (i) seeing

(ii) questioning, (iii) touching and (iv) diagnosing about their nature of disease and then treat them accordingly[23]. The *Āyurvedic* system mentions eight points of patient's examination, i.e., sight, touch, facial nature, voice, tongue, faeces, urine and nature of pulse and its rate etc. It has to be investigated whether pulse examination got current in Ugraditya's time as he has not mentioned this important aspect of patient's examination.

(iii) *Nurses* : Nursing is as necessary for patients as the doctor. Ugraditya points out that the nurse must be strong-willed to serve others. She should be smiling, skilful, kind and patient to the patients and must be able to bear the inconveniences from both sides. However, it is not mentioned whether they should be males or females only. It seems both sexes could have occupation of nurses.

(iv) *Medicines* : It has been said that the canonical age medicines were normally non-violent, herbal, vegetable, mineral, their decoctions, extracts and mixtures. A good medicine is defined as that which is prepared by genuine methods and is disease-curing in small amounts. A nurse must be well-versed in preparing and administration of medicines. Of course, besides medicines, nature cure and demonic cure methods are also included in medicines of canonical times.

Topics Under Medical Learning[24]

Many canons have indicated the following eight subjects to be taught for physicians during their training with some variance in their Samskṛta names and their order :

(i) Paediatrics (*Kaumārbhṛtya, Bālarakṣā*)

(ii) Surgery and Midwifery (*Śalya*)

(iii) Ear, Nose, Throat and Eye treatment (Śālakya)

(iv) Internal and External Medicines (*Kāya-cikitsā*)

(v) Toxicology (*Agada* or *Jaṅgala*)

(vi) Demonology and Ash-thread Therapy (*Bhūtavidyā, Bhūtikarma*)

(vii) Geriatrics or Longevity (*Rasāyana*)

(viii) Aphrodisiacology or Rejuvenation (*Vājikaraṇa, Kṣāra-tantra*).

These topics seem to be quite few and their scopes should also be quite incomplete with respect to twentieth century development of mechanical, electrical, electronical and penetrating rays appliances besides more accurate knowledge about the internal and external systems and their mechaṇisms in the body. Still, they could not be discarded off hand as they contain the seeds for all later developments. Moreover, the general Indian villager is still being cured by this system in majority. Though anatomy and physiology do not find mention here, but they seem to be included in surgery and other related branches.

Diseases and their Causes

The disease, in general, is a disturbance in human physical and/or psychological system. This may be natural or accidental, temporary, chronic or fatal. It always causes pain and undesirability. The external causes of pain are nine as per *Sthānāṅga*[25] : overeating, improper posture or food, over-sleeping, over-walking, constipation, urinal-obstruction, over-sex and adverse food. These causes result in four types of internal, elemental or humoural changes named as disturbances in (i) rhenum (air), (ii) bile substances, (iii) phelgmic substances and (iv) in the mixture of these three[26]. This canonical statement differs from three defect-based *Āyurvedic* system. The medical diseases are, therefore, classified on the basis of these causes. B. A.[27] and Ugraditya also support these three principle system in contrast to the canonical one, which seems to be more accurate. However, Ugraditya has classified the diseases under two common-sense heads : (i) significant numbering eight and (ii) non-significant including demonology and toxicology numbering forty-five, representing the acuteness of the diseases. Religiously, he also points out that the primary cause of disease is former kārmic accumulation. Others have pointed out the possession by demons in addition. The current

allopathic system does not classify diseases on this basis. It is based on various systems working in the body like nervous, bone and joints, endocrine, excretory, digestive, respiratory, cardiovascular system and genetic, infectious and psychological disorders[28]. This suggests that the current medical practice has gone on specificity rather than *Āyurvedic* generalism.

Diseases Taught

Canons mention large number of diseases as observed during those days and for which treatment was done. With the exception of *Rayaṇasāra* (10 diseases) and *Bhagavatī* (12 diseases), most other canons have 16 or more diseases. Some later texts have constancy in number with many names differing. *Jīvajīvābhigama* goes for 36 diseases. B. A. has an alarming number of 5, 68, 99, 584 for disease mentioning that there are 96 diseases in the eyes alone[29]. Moreover, Kundakunda has to say a little differently that 1.65cm. (1 *aṅgula*) of body may have 96 diseases[30]. This gives, on calculation, the total internal and external length of the body as 9.78 kms. and total volume of body as approximately one cubic meter if the body density is taken roughly to be one. This, if corrected for the size of the eye as 4.5 cms., still seems to be 3.62 km. equivalent to still an imaginary quantity. However, if we overlook this calculation of B. A., we find that the total number of diseases goes upto more than five dozen as shown in Table 1. This suggests that the number of disease have been gradually increasing in different canonical periods leading to the guess of their later and later compositions. The subclassification of fever, different types of community diseases, inclusion of infections, measles, ringworm, heart pain and psychological diseases in later texts also suggest a gradual development towards finer approach in medical learning. This list also points out that nearly all types of general diseases were existing in canonical days as are existing today with the exception of assumed demonal diseases which seem to be more psychological in current views. Currently, the number and complexity

of diseases have gone enormous.

Table 1 : Names of Diseases in Jaina Canons.

1. Goiter (*Gaṇḍamāla*)
2. Leprosy (*Kuṣṭha,* 18 types)
3. Tuberculosis (*Rājayakṣmā*)
4. Epilepsy (*Apasmāra*)
5. Blindness or 1-eyedness (*Kannika*)
6. Stiffness in parts (*Stimitatva*)
7. Lameness (*Kunitva*)
8. Hump-backedness (*Kubjitva*)
9. Fatness or Dropsy (*Udarī*)
10. Dumbness (*Mūkatā*)
11. Swelling (*Śotha*)
12. Over-apatite (*Bhasmaka*)
13. Trembling (*Kampana Vāta*)
14. Dis-ablement (*Pṛṣṭa-sarpī*)
15. Elephantitis (*Ślīpada*)
16. Diabetes (*Madhumeha*)
17. Infectious/Contact Diseases (*Sparśa Roga*)
18. Fatal Diseases (*Ātaṅkī Roga*)
19. Asthma (*Śvāsa*)
20. Cough & Whooping Cough (*Kāsa*)
21. Fever (*Jvara*)
22. Inflammatory Fever (*Dāha-jvara*)
23. Intestinal/belly ache (*Kukṣiśūla*)
24. Fistula (*Bhagandara*)
25. Piles (*Arśa*)
26. Paralysis (*Dhanurgraha*)
27. Flatulence, gastric (*Udara Vāta*)
28. Indigestion (*Ajīrṇa*)
29. Headache, Head cholic (*Mastakaśūla*)
30. Eye-colic (*Akṣi-vedanā*)
33. Itching and scabbies (*Kaṇḍū*)
34. Apatite Loss (*Aruci*)
35. Uterus Colic (*Yoniśūla*)

36. Genetic Disease (*Kula-roga*)
37. Community Disease (*Grāma-roga*)
38. City Disease (*Nagara-roga*)
39. Commissionery Disease (*Maṇḍala Roga*)
40. Nasal Disease (*Nāsikā Vedanā*)
41. Dental Disease (*Danta Vedanā*)
42. Nails Disease (*Nakha Vedanā*)
43. Measles
44. Demonal Disease (*Indragraha*)
45. Demonal (*Skandagraha*)
46. Demonal (*Kumāragraha*)
47. Demonal (*Bhūtagraha*)
48. Demonal, Demigod (*Yakṣagraha*)
49. Demonal (*Nāgagraha*)
50. Psychological/Emotional Disease (*Udvega graha*)
51. Intermittent Fever (*Ekānta jvara*)
52. 2-day intermittant fever (*Caturāhnika jvara*)
53. 3-day intermittant fever (*Tryāhnika jvara*)
54. 4-day intermittant fever (*Caturāhnika jvara*)
55. Heart Pain (*Hṛdayaśūla*)
56. Ribs Pain (*Pārśvaśūla*)
57. Ringworm (*Dadru*)
58. Billous Fever (*Pitta Jvara*)
59. Dysentry (*Atisāra*)
60. Typhoid (*Sannipāta*)
61. Nausea (*Balguli*)
62. Rheumatism (*Vātaka*)
63. Pimples (*Viṣkumbha*)
64. Wormy Leprosy (*Kṛmi Kuṣtha*)

Medical and Surgical Practices

The Jaina *Prāṇāvāya* system mentions various medical and surgical practices with not very much details about them. However, the contemporary and later literature mentions quite a lot about them. The various types of medications have been classified by Ugraditya under four heads :

(i) Causticisation, (ii) Branding, (iii) Medicinal substances and (iv) Surgery.

The different practices could be classified under these heads. However, a better classification would be based on the nature of medication under current terms : (i) physical, (ii) surgical, (iii) medicinal and (iv) psychological processes. They are described below. It must be noted that all the physical processes have some type of medical action on the diseased part.

(*i*) *Physical Methods*

1. Rubbibg with oil
2. Rubbing with powder
3. Oil drinks
4. Vomitting
5. Purging with drugs
6. Medicated bath
7. Syringing bladder
8. Oil enema
9. Bathing hair with oil
10. Nourishing with oils
11. Nourishing with cooked oils
12. Use of hairy/hairless leather
13. Wrapping with fur or leather
14. Sweating
15. Massaging
16. Special anointing
17. Pressing/sneezing
18. Sun-bath
19. Water bath
20. Mud/earth poultice
21. Leeching
22. Administration of medicines (bark, rhizomes, bitter and juicy extracts)
23. Making herbal tablets
24. Preparing special medicines
25. Preparing mixtures of medicines
26. Medical fumitigation/ incensing
27. Making decoctions and multiple digestions
28. Causticisations
29. Leaf and ground leaf poultice

(*ii*) *Surgical*

1. Opening veins or acupuncture
2. Cutting

3. Fine cutting
4. Thorn pricking
5. Branding
6. Post-surgery care
7. Scraping

The number of these processes has increassed from 4 in S. K. and 5 in *Ācārāṅga* to more than 30 in total. It is clear that there are about 29 medical practices and seven surgical ones. This suggests medical treatment to be more prevalent. Ugraditya mentions sixty such practices – a notable development over the canonical period. Most of these are used today with a little better fineness.

Different Types of Medicines

The medicines mentioned in the canons belong to the ten categories :

(a) Different parts of medicinal plants,

(b) Extracts or decoctions of plants,

(c) Minerals and metal-formed compounds,

(d) Dried plants or their parts,

(e) Mixtures of varying number of constituents,

(f) Medicinally smoking compounds of varied nature,

(g) Spirituous decoctions and extracts.

(h) Skins of animals (ram, hyena, tiger) with or without hairs (for flatullence, paralysis and leprosy[64]),

(i) Urines (for snake bites); rice powder and honey (for fistula),

(j) Specially prepared oils (for massaging or annointing)

The medicines are supposed to be effective only when given in proper quantity and for stipulated time. It seems that the last category above contains small amounts of alcohols but it is presumed to be harmful or un-usable in practice. Moreover, the canons do not make any reference to mercury except in *Prajñāpanā* and *Jīvajīvābhigama*[32] which are taken as later compositions. This means that medical use of mercury is a post-canonical phenomena.

The canons mention evil spirits and demigods. It seems

that demonology was one of the important learnings of those days. It is also a section of *Āyurveda* and *Prāṇāvāya.* The demonical diseases are defined as those which are incurable by any type of medical treatment. They are supposed to be caused by eighteen different types of demigods[32]. The irreligious, deceitful and lonely people do suffer from these diseases. These could be treated by re-directing and strengthening the inner energy by incantational, meditational and austere practices. Per chance, the general and mastered medicines are not effective in such cases. The medical practitioner of canonical age was, thus, required to be proficient in demonology also. Currently, these are treated as psychological depressions and meditation etc. are taken as means to improve them.

Anatomical Descriptions

Ācārāṅga[33] gives names of 32 parts of human body and nine forms of excretions in comparision to twenty in case of Dhanna monk[34]. There are no details about them, however, as to their structure and shapes etc. But canons like B. A., T. V. give us some anatomical details of human body as shown in Table 2 and 3. It contains some internal details too. It is said that in many cases, women have lesser number of parts. The comparative tables suggest that there is a good amount of similarity between *Prāṇāvāya* system and *Āyurveda.* But the details of *Prāṇāvāya* are more varied and quantitative. One can discern differences in number and weight in most cases between the old and current medical systems. However, it is surprising that datas either lack or are not easily available in current system in many cases, reported in canons. Here, the weight calculations have been given on the basis of[35]

1 *Pala* = 4 *Tolas* = 46 gms.

1 *Añjali* = 4 *Palas* = 16 *Tolas* = 184 gms.

1 *Prastha* = 4 *Añjali* = 16 *Palas* = 64 *Tolas* ~ 800gms. ~ 0.80 Kg.

The author hopes that scholars will be encouraged to express the qualititative contents in current units of length

(cms.) and weights (gms.). This will make better comparative evaluation.

Table 2 : Anatomical Parts in Human Body : Numerical Data.

No.	Name	TV	BA	KK	AY	Med. Sc.
1.	Bones	300	300	300	300/360	206
2.	Joints	300	300	300	210	–
3.	Tendons	900	900	900	900	–
4.	Nerves/Veins	700	700	700	700	–
5.	Muscles	500	500	500	500	519
6.	Atreries	–	–	24	24	–
7.	Large Veins	–	16	16	16	–
8.	Fleshal Sinews (*Māmsa-rajju*)	–	2	2	4	–
9.	Skin	–	7	7	7	5
10.	Defecation Points	–	7	7	–	–
11.	Vital Spots (*Marmasthala*)	107	107	107	107	–
12.	Houmours	–	3	3	3	–
13.	Anuses	9 (men) 11 (women)	9	9	9	–
14.	Liver Parts	–	7	--	–	–
15.	Nails/Fingers	–	20	20	20	20
16.	Teeth	–	32	32	32	32
17.	Airs	–	5	5	–	–

Table 3 : Quantitative Details about Anatomical Statements.**

No.	Name 1	TV 2	BA 3	Ay 4	Medical Sc. 5
1.	Large Intestines	–	16	16	1.5 m (length)
2.	Liver	–	1	1	1.2-1.8 g
3.	Spleen	–	1	1	150-200 g
4.	Brain	–	184 g	184 g	1400 g
5.	Semen	–	184 g	–	5 ml. (app.)
6.	Blood	1.70 kg	1.70kg	–	4-5 ltres.
7.	Faeces	--	1.7-3.4 kg.	–	200 g

1	2	3	4	5
8. Urine	–	0.80kg	–	1.5 kg
9. Eyeballs	90 g	–	–	–
10. Ribs	18	–	–	24
11. Heart	1.15 kg	–	–	0.2-0.35 kg
12. Tongue	205 g 12 cms	–	–	–
13. Soft hairs	350 lacs	80 lacs	–	–
14. Fat	–	552 g	–	–
15. Bile liquids	–	552 g	–	–
16. Cough	–	552 g	–	–
17. Stomach	450 cms	–	–	–
18. Bone marrow	–	205 g	–	–

** BA and KK details differ in ratio of 3 : 1.

Physiology

Physiologically, the eatables have been classified by their rhenum, bilous and phelgmic nature. Their digestions produced different effects in the system in terms of their exothermic, endothermic or mixed type of biochemical actions in the stomach. It is said that the food when chewed and mixed with saliva gets mixed up with bile in stomach and gets bitter. On further digestion, this produces primary fluids in the body which are converted into blood, flesh, fat, bones, marrow and semen in order. These fluids are also utilised by the embryo for its nourishing at different stages.

There is good description about foods and nutrition in different canons which has been detailed in the relevant chapter to which the reader is referred to.

Obstetrics and Gynaecology : Procreation and Pregnancy

Current obstetrics and gynaecology deals with diseases related with females specially and their procreative systems. Nature has provided the method of procreation to continue the species and the world. This branch is included in *Śalya* system of *Prāṇāvāya*. It is said in canons that the 5-sensed mammals

generally procreate sexually in contrast to the deficient-sensed ones. There is, therefore, little details about the procreation of these beings. However, sufficient details are available for procreation of mammals specially human beings. It is said that they are nucleated by mixing of semen and blood in the uterus where they grow by maternal intakes and are born with placenta in due course. Some striking statements are also there in this connection many of which need current verification. They are given below :

(a) An embryo can remain in the womb during a period varying between 48 minutes and 24 years[36].

(b) The semen in uterus remains active for a time varying between 48 minutes and 12 x 48 = 9.5 hours. The scientists would tell this time between 24-72 hours[37].

(c) An embryo in the womb may be procreated by a minimum of one, two or three upto a maximum of 200-900 mammals. This statement seems to be based on '(b)'. This suggests a coitus of 0.64 minute per mammal[38].

(d) A female can be a progeny of 2-9 lac procreations in one copulation. This is dependant on the number of sperms in male semen and efficiency of producing eggs by the females. This should be taken as a statement regarding potentiality rather than actuality. However, innumerable number of embryoes are destroyed during collisive intercourse.

(e) Kundakunda says that there are innumerable micro-organisms in the vagina, breast, chest, navel and shoulder joints of women. Nothing has been said about males in this regard[39].

(f) It is said that the (i) bones, (ii) bone marrow and (iii) nails, beard, soft and normal hairs of the embryo are formed with paternal contributions while (i) head, (ii) flesh and (iii) blood are contributed maternally. Rest of the parts of the embryo are formed from blood and semen. These parts last unto the end of the physical body[40]. Different limbs are given in Table 2. The modern medical sciences talk about chro-

mosomal contributions for embryo rather than limbal contributions.

(g) The developing embryo lies on the back, sides or mango-like curved postures in the womb. His activities and emotions correspond with that of his mother. He comes out of womb with his legs or head. His nature depends on auspicity or otherwise of his accumulated *Karmas* also. While coming out of the womb, the child weeps creating pains to his mother[41].

(h) The embryo has only psychical senses, luminous and *kārmic* body at first. It does have neither physical senses nor body in gross. Its first intake is the emulsion made up of mothers blood and fathers semen. Later on, it intakes biochemical liquids, fludis or elixir produced from digestion process of mother's intake. This intake from all sides is later gradually transformed into various organs. Due to this the developing embryo does not have different types of excretions. Still later, it takes the elixir produced from mother's intake through a sprouted tissue[42].

(i) Different narratives in the canons indicate that the foetus is effected by physical and mental environment and thoughts of the mother. Her psychology effects the nature of the would-be child[43]. Modern scientists have confirmed this canonical opinion through experimental technics. Moreover, the nature and composition of semen and ovarious egg also effect the developmental characteristics of the foetus. The equation of completions with chromosomes does not seem proper as while one is said to be a form of energy, the other is a series of chemically complex compounds. The science of dreaming and prognosticism has also been related to pregnancy results as narrated in narratives of *Kalpasūtra, Bhagavatī* and *Antakrita.*

(j) There is mention of longings of pregnant women in the third or fourth month of gestations. These involve peculiar desires like artificial clouds, demon worship, eating of ones own husband's flesh etc. It is said that if longings are not satisfied,

it effects the proper physical and mental formation of the foetus[44].

(k) *Jñātādharmakathā* and other canons mention about the proper foods and drinks to be intaken by pregnant ladies. They should be nourishing and according to seasons avoiding extremes of tastes and constituents injurious to health. It is stated that mother's food also effects the foetus[33b].

Besides these statements, the canons like B. A. and T. V. describe about the process of development of embryo during pregnancy. Table 4 gives a comparative statement about it in canonical, Āyurvedic and modern science. It suggests that the old descriptions are somewhat different and comparatively elementary with respect to medical sciences. Though the first month development seems to be similar, but later development differs to a large extent. Sex determination of the foetus is a third month phenomena now. The height and weight measurements of embryo and foetus vary between 10^{-4}cm. to about 50 cms. and 10^{-4}g to about 3.0 kg. While canons describe a foetus having only flesh and limbs in 2-3 months, medical science finds even heart, brain and sex signs during this period. Pregnancy longing is said to occur in varying (3rd or 4th) months. The canonical conceivability age is also a matter of dispute for the westerners.

The present *Āyurvedic* system is utilising some of these facts into their new forms. Canons and old literature should, therefore, be taken as historical records of the existing knowledge and growth of knowledge should be taken as an esatablished fact. The statement of authentication of canonical descriptions should, hence, be taken not in literal sense but in the sense of reverence to the venerables.

(l) The position and shape of uterus canonically described externally is nearly as per current ideas as shown earlier.

(m) *Sthānāṅga*[45] and other canons have discribed the conditions under which there could be conception or no conception with or without copulation. Similarly, methods of annihi-

Table 4 : Development of Embryo and Foetus in Different Systems.

No.		T. V.	B. A./K. K.	Ay.	Medicinal Science
1		2	3	4	5
1.	Conceivability Age	55 years F 75 years M	— —	— —	— —
2.	First Week	Multicellular	—	—	—
3.	Second Week	Monula	—	—	—
4.	Third Week	Blastula	—	—	—
5.	Fourth Week	Shaped fleshly mass	—	—	—
6.	First 10 days	—	Multicellular	—	—
7.	Second 10 days	—	Monula	—	—
8.	Third 10 days	—	Blackened mass Compaction of mass	—	—
9.	First Month	35 gm	—	Multicellular Monula	Multicellular Monula, blastula by cell division 0.85 g
10.	Second Month	Squared solid fleshy mass	Fleshy bubble	Fleshy, solidifying blastula, muscles	Shaping like human, heart brain, sex-signs, indistinct heart, 3.75 cms.
11.	Third Month	Longing (GJK)	Solidification	5 limbs distinct, sublimbs indistinct	Muscles, Nerves, Bones, Fingers, Longing, 14g,9 cms

1	2	3	4	5
12. Fourth Month	Longing (VS) Swelling in body	Fleshy shape	Developed limbs, sublimbs, head, heart, longing	5 limbs, sublimbs, distinct sex longing, 16.5 cm, 100 g
13. Fifth Month	Limbs, Sublimbs grow	Limbs form	Brain, mind active	Limbs, Sublimbs, hairs, movements, excretion, 300 g, 25.5 cms.
14. Sixth Month	Bile and Blood	Limbs/Sublimbs grow	Intelligence	Full development, skin, hairs, 32 cms, 650 gms. fat.
15. Seventh Month	Nerves, Arteries,	Skin, Nails, Hairs	All limbs/Sub-limbs grow	Increase in size, action, breathing, 38 cms, 1kg
16. Eighth Month	Completeness of foetus	Movements	Movement/Vitality	Growth, 43 cms, 1.8 kg.
17. Ninth Month Tenth Month	—	Nourishment, Delivery	Nourishment, Delivery	Critical growth delivery, 46 cms, 2.5 kg.
18. Total delivery time	277.5 days	—	280 days	240-280 days
19. Conceivability	Maximum 9.5 hrs after coitus	—	—	24-72 hours after coitus
20. Number of lives in womb	2-9 lacs	—	—	—

lation or translocation of embryo/foetus have also been described.

The conception could occur naturally by copulation or introduction of male semen into uterus by different methods mentioned in *Sthānāṅga* :

(i) The ejaculated male groundlaid semen may be attracted towards the vagina of a female when she has her hidden vagina open over it.

(ii) The introduction of semen particles in vagina through wearing the semenlaid clothes of men.

(iii) The introduction of semen particles in vagina because of strong desire for issues.

(iv) The introduction of semen particles in vagina while bathing in river, ponds or public places.

(v) The introduction of semen particles by others into the vagina of women out of these five methods, only the fifth has been gaining ground on scientific lines. This, however, has become a reality, sometimes even in the absence of women vagina. The ancient *niyoga* method could be exemplified by this process. Artificial insemination of animals is a common practice to improve the breed. Test tube babies of today are another example where the embryo is developed by external combination and then its introduction into the uterus of original or different female to avoid conception and birth pangs. Laboratory genetics is also a recent pointer. The *Āyurvedic* system mentions of pregnancy through women copulation or by dreaming during menses alone[46].

The canons do not seem to give confirmed examples of such uncopulated births except in the case of mother of Kesīkumāra in the second category[47]. All the first four categories are just accidental and not normal. Their mention gives us idea of keen thinking and observation power of our seers. The canons, however, mention the transfer of foetus of Mahāvīra through the miracle of a demigod from one uterus to another

per chance a third method of pregnancy[48]. Moreover, this is a case of transfer of foetus rather than conception. The mention of non-sexual method of human conception seems to be the influence of Hindū mythology where many such cases are described. However, there are no such cases through human skill in canons.

There is only one canon which mentions that there may not be any conception even when there is sexual copulation. Fifteen conditions have been described which are self-explanatory in this regard[49]. A woman may not conceive when

(i) she may not be properly young.
(ii) she may have gone aged.
(iii) she may be barren.
(iv) she may be having disease.
(v) she may be bereaved.
(vi) she may be always in menses.
(vii) she may always be without menses.
(viii) she may not conceive due to weakness in uterus.
(ix) she may have approached menopause.
(x) she may have un-natural sex or oversex.
(xi) she may have undercopulation.
(xii) she may have destruction of semen sperms.
(xiii) she may have weakness in bilous blood.
(xiv) she may have demigodal effect.
(xv) she may have absence of *Kārmic* accumulation useful for reproduction.

Most of these causes are still assumed as possible reasons for non-conception. However, the structural deficiency and quantitative compositional issues are also, now, involved in the process.

It seems strange that while on the one hand, pregnancy is described as a fortunate blessedness of a female life, there have always been some physical, mental or circumstantial compulsions when this was taken to be undesirable. A a result, methods of abortion or mis-carriage have also been in vogue.

The canons describe four methods :

(i) Cutting the foetus to pieces.

(ii) Dis-solution of the embryo.

(iii) Foeticide.

(iv) Abortion.[50]

Various oily, alkaline, bitter and astringent medicines and drinks were used for the purpose besides manual and surgical steps. The abortion was a socially condemnable practice in early days. However, time has changed and the last quarter of twentieth century has a message of encouraging abortion for family planning and unrestricted physical enjoyment. This point may be taken against religion but that is the issue with which twentieth century is completing itself.

Geriatrics and Aphrodisiacology

These branches of medical sciences were very popular in canonical days. This could be judged by the ancient tonic named *'Cyavanaprāśa'* made by the Ṛṣi for vigorous youthfulness. In fact, everybody wishes to live longer and enjoy maximum in the world. Like many allopathic tonics of today, there were many *āyurvedic* tonics in the past to keep men away from diseases. Canons mention about multi-component extracts obtained by multiple decoctions and formulations which were utilised for the two purposes. Later, many synthetic compounds and their mixtures were developed and mastered under this branch. Kalyāṇakāraka[51] gives many such prescriptions in this direction. Current medical science has recently started these branches to improve the internal anatomy of ageing and rejuvenation. Man, now, can hope to be better long-lived than before.

Toxicology

This branch deals with three types of poisons or toxic substances of botanical, zoological and synthetic origin. *Sthānāṅga*[52] mentions that poison may be effective due to (i) biting as by serpents, rats, insects and other animals (ii) eating

a poisonous material and (iii) sight and touch. It effects flesh, bone-marrow and blood too. It seems that serpents, scorpions etc. were very common in canonical age of village culture. That is why a good amount of description about them and treatment of their bites is found in canons. Urine drinking, earth poultice, blood extracting, sucking and branding the bitten points and drinking gold water were the normal treatments[40]. Use of concentrated amulet and occult arts were also in vogue. These were practiced even in eighth century. Ugraditya had added much more to this branch. Now-a-days, different chemical compounds of toxic nature have been prepared. Insecticides, pesticides, wormicides and the like are also toxic to human beings though not to such an extent as to small creatures. They do not find mention in canons. Besides, many more poisonous creatures have been observed and their toxicity points and components together with a variety of medication have been added.

Surgery

The diseases under surgery are mostly accidental. Examples of abscess, cuts, wounds, goitre, fistula, piles and internal thorns are found in different canons. They were treated through various surgical practices and medications as mentioned earlier. The medical practitioner was supposed to carry all his practicing equipments with him all the times. One could form an idea about the progress of surgery when one listens to bye-pass, heart and other transplantation surgeries of today. They were not known or per chance not necessary in canonical ages.

Death and After

Medication is meant to delay the death as much as one can. The livingness is defined as an activity or energy due to (i-v) five senses, (vi-viii) speech, mind and body, (ix) respiration and (x) life-span. These are knwon as *'Prāṇas'* or vitalities. The living one is *'Prāṇī'* because of them[54]. Death denotes loss of *Prāṇa* or devitalisation at the destruction of

specific life-span *karma*. This *karma* refers to either this birth or the other births with same form and destinity. The medical sciences refer to the current birth alone. The death is as natural a phenomena as the birth. These two are the two banks of the ocean of world. The birth process has been described quite in detail. No such details are available for death process. However, there is mention of causes and classification of death in canons. People enjoy birth but feel fear for and sorry at death. The religion teaches us to welcome death like birth with proper preparedness.

Causes of Death

Many canons refer to causes of death -- some in detail and some in brief. *Sthānāṅga* says there are seven causes of death. Kundakunda and Śivārya have 14-16 causes. They seem to be mostly extension and elaboration of *Sthānāṅga*. However, death by rope trap, cutting tongue, demigodal inflictions or immoral acts indicate these practices in those times. These causes are shown in Table 5. It is surprising why. *Śivārya* does not mention fear and sorrow as the causes of death. They are psychological causes. The difference in Kundakunda and *Śivārya* lists require further studies. These causes lead to shortening or cutting the life-span.

Table 5 : Causes of Death in Different Canons[55].

Sthānāṅga 1	Kundakunda 2	Śivārya 3
1. Fear, Sorrow etc.	1. Fear	—
	2. Sorrow	—
2. Instrumental	3. Weapons	1. Weapons
	4. Fire or overheat	2. Fire/overheat
	5. Overcold	3. Overcold
	6. Bloodflow	4. Smoke
		5. Taking out tongue
		6. Rope trap

1	2	3
3. Over-eating	7. Overeating or no-eating	7. Overeating/no-eating
		8. Unnatural foods
		9. Thirst
4. Severe pains	8. Severe pains	–
5. External causes	9. Drowning in water	10. Drowning in water
	10. Fall from mounts	11. Fall from mounts
	11. Fall from tree	12. Fall from tree
6. Touch	12. Poisons, snakebites etc.	13. Poisons etc.
7. Respiratory obstructions	13. Respiratory obstructions	14. Respiratory obstructions
	14. Demigodal	–
	15. Overmeditation	–
	16. Immoral acts	–

These causes do not include death by trance or voluntary ritual. As these also do not include accidents due to many transport mediums, it seems certain that the modern transport mediums were absent during canonical days. But these could be included in death by external causes. Failure of body parts like heart, kidney etc., is also not here which is very prevalent now-a-days. Here weapons may include bombs also.

Kinds of Death

Basically, death has two varieties – (i) natural, timely or normal and (ii) unnatural, untimely or accidental. It is very difficult to define natural death except that it occurs when the life-span *karma* for the current birth is destroyed. There are very few varieties of living beings which might have natural death. Most have other form of death due to causes described above. The canons, however, indicate two types of death – (i) death of a fool, ignorant and (ii) death of a prudent. They

have many classes under each head in canons as shown in Table 6. They may vary from five to seventeen with different names, order and sometimes meanings. It is seen that *Bhagavatī* classification is a mixed one having many causes in addition to types. The other classifications give either qualification or condition of the dying person. It is said that death of a prudent is better than that of the fool. The BA has classified prudents in four varieties and the fools in five classes. Alternatively, BA has five types of deaths which seems simplification of seventeen types.

Table 6 : Kinds of Death in Canons.

Bhagavatī[56] 1	*Samavāo*[57] 2	B. A.[58] 3
(I) *Death of Fool*		
1. By starvation	By starvation	By non-restraint
2. By over-sense submission	2. By over-sense submission	2. By over-sense submission
3. By inner thorns	3. By inner thorns	3. By inner thorns
4. By condemning same birth	4. Condemning same birth	4. Condemning birth
5. Due to hanging	5. Due to hanging	5. Due to hanging
6. Due to piercing by wild animals	6. Due to piercing by wild animals	6. Due to piercing by wild animals
7. Due to fall from mountains	–	–
8. Due to fall from tree	–	–
9. Due to drowning in water	–	–
10. Due to entering in fire	–	–
11. Due to taking poisons	–	–

1	2	3
12. Due to hurt by weapons	–	–
	7. Extreme death	7. Extreme death
	8. Limiting death	8. Limiting death
	9. Wavelike death	9. Wavelike death
		10. Beginning-end death
(*II*) *Death of Prudent*		
13. Unserved renunciated death by lying steadfast like a tree	10. Death of a fool	11. Death of a fool
14. By rejecting gradual food intake	11. Death of Prudent	12. Death of Prudent
	12. Unserved renunciated death by lying steadfast like a tree	13. As under col. 1
	13. As in column 1	14. As in column 1
	14. Self-served renunciated death	15. As in column 2
	15. Death of prudent-cum-fool	16. As in column 2
	16. Non-omniscient death	–
	17. Omniscient death	17. As in column 2

Whatever may be the cause or type of death, the canons suggest a devotional, religious and pious mind at the time of death for better rebirth. The canons do not mention any methods by which life-span could be increased except that religious and merited activities could mutate things for the better. *Dhavalā* says that a person could destinate himself either at the last one-third of current life-span or in the last 48 minutes of his current life[59]. The medical science is groping deep into the science of ageing and trying to increase the life-span as much as possible. Keeping at lower temperature[60], undereating by 10%[61], reducing neurological defects, supplementation of

essential chemicals and biochemicals, implantation and transplantation of body parts and creating psychologically satisfying conditions and purer environment are some of the methods used today.[62] This has resulted in increasing the average life-span of Indians from 27 to 57 yrs. after independance. The deterministic *kārmic* theory of the Jainas has taken a dynamic form in physical sense even in twentieth century. The medical science is moving the way to attain immortality in this visible world because it has learnt about the immortality of primary basic cell of life.

The After Life

The Jaina canons point out the existence of four destinities for the living beings – human, sub-human, hellish and celestial. It is presumed that every living being is reborn in any one of these after his death in current life. The omniscients and liberated ones are exceptions. They do not have rebirth. When one dies, the inner of the living associated with caloric and *kārmic* bodies moves up for one, two, three or four instants of time in straight or curved line and assumes his destined place for the next birth, of course leaving his gross body what we call as dead[63]. Most of the Indian philosophies believe in rebirth. However, parapsychologists are not unanimous about it. They feel it a question of faith and self-experience rather than actuality. However, the concept of rebirth has proved to be one of the important psychological tool for men to satisfy their optimism about the better future.

Conclusion

The above description shows that there are large number of contents on different aspects of contemporary medical science – called *Prāṇāvāya* or *Āyurveda.* It suggests that theoretically, they have every point of current medical learning. However, looking to the contents, the quality may not be very perfect. It has more visual, empirical and external nature. It does not contain internal structure, mechanism and components responsible for curing the normal or deficiency diseases.

Also, the contents do not have sufficient accuracy in quantitative aspects. However, all these above contents reflect the varied interests of Jaina scholarly seers and the state of medical learning of their age. By comparative studies of canonical and current knowledge, one could guess the advance made by men in this branch of learning during the intervening generations.

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